Proposal for New Academic, Research or Service Endeavor

(formerly Appendix A)

COVER SHEET

Entity

- ☐ New Curriculum
- ☒ New Academic Program
- ☐ New Research Endeavor
- ☐ New Academic Center or Institute

Academic degree to be awarded

- ☐ Bachelor of Arts
- ☐ Bachelor of Science
- ☐ Master of Arts
- ☐ Master of Science
- ☒ Doctor of Philosophy (Ph.D.)
- ☐ Post-Baccalaureate Certificate
- ☐ Post-Master's Certificate
- ☐ Certificate of Graduate Study
- ☐ CE Academic Certificate
- ☐ Other:
- ☐ N/A

Exact name of degree: Doctor of Philosophy in Physics

- ☐ Untagged degree (e.g. Bachelor of Science)
- ☒ Tagged degree (e.g. Bachelor of Science in Electrical Engineering)

If new Undergraduate degree, granting College/School: _____

Sponsoring department or academic unit: Physics

For degree programs please indicate the minimum GPA required for graduation: 3.0

Please check all that apply regarding the following aspects of the program that may impact students' financial aid and/or institutional compliance with federal regulations. Elaborate as appropriate in the body of the proposal.

Location/Travel

- ☐ 50% off site
- ☐ substantial clinical/practicum travel
- ☐ required travel component

Delivery Method

- ☒ Standard delivery only
- ☐ Online delivery only
- ☐ Hybrid delivery
- ☐ Hybrid delivery

External Collaborations

- ☐ Degree offered jointly with another institution

Calendar (choose no more than one)

- ☒ Main campus calendar
- ☐ College of Medicine calendar
- ☐ Distance Education calendar

Financial Aid*

- ☐ Online program with differential tuition rate
- ☐ Residential program with differential tuition rate

*A request for differential tuition may be submitted when the program has been approved by the Curricular Affairs Committee. This will allow approval of the differential tuition concurrent with the Board of Trustees approval (if approved). The process and guidelines for requesting differential tuition can be found at http://www.uvm.edu/~gradcoll/?Page=VariableTuition.html&SM=Facultystaffmenu.html

Physics Ph.D. at the University of Vermont

This proposal provides an assessment of the reasons for, and resources required to establish and sustain a Ph.D. program in Physics at the University of Vermont. Vermont currently stands as the only state in the country without a Ph.D. program in Physics. This proposal aims to build one which will grow the University's reputation as a regional leader in the physical sciences, incubate new interdisciplinary research and education opportunities on campus, and enhance the future scientific and economic development of the state. Graduate students in the program will perform research in subfields of physics that are aligned with current strategic departmental strengths including condensed matter physics, biological physics and astronomy/astrophysics.

We discuss two new graduate courses required for the curriculum and present a detailed start-up plan for the first 5 years of the program. While outlining needs for additional departmental growth in the future, we propose that the Ph.D. program can be reinstated in manner that is revenue neutral or positive within current budget models.

I Program Summary

I.A Program Title

Ph.D. in Physics

I.B Directorship

The director of the Physics Ph.D. program will be assigned by the Physics Department faculty with all full time tenure-track faculty members being eligible provided they are also members of the Graduate College. Each director will serve a term of three years with continuing terms subject to the approval of the Physics Department.

I.C Participating Faculty

As of Spring 2017 eligible Physics faculty members include:

Name	Rank	Research Interest
Dennis Clougherty	Professor	Condensed matter and atomic theory
Adrian Del Maestro	Associate Professor	Condensed matter theory
Madalina Furis	Associate Professor	Condensed matter experiment
Randall Headrick	Professor	Condensed matter experiment
Valeri Kotov	Associate Professor	Condensed matter theory
Joanna Rankin	Professor	Astronomy and Astrophysics
Juan Vanegas	Assistant Professor	Theoretical biological physics
Matthew White	Assistant Professor	Condensed matter experiment
JunRu Wu	Professor	Biological physics experiment
Jie Yang	Associate Professor	Biological physics experiment

The anticipated start date is Fall 2019. In general, based on external program reviews and other successful Ph.D. programs recently launched, we estimate the long-term target should be between 12 and 14 faculty members to support growth of the program. The current College of Arts & Sciences 5-Year Strategic Plan calls for the hiring of an additional Physics tenure-track faculty member.

I.D Responsible Academic Unit

College of Arts & Sciences

I.E Program Description

A Ph.D. in Physics is the highest degree awarded in the field, and it is the standard graduate degree. Very few (only 7% nationally) of students pursuing a graduate degree in Physics choose to pursue a terminal masters degree. UVM Physics intends to reinstate the Ph.D. program in

order to be competitive in recruiting, educating, and training the top 93% of Physics students interested in graduate school. The Department of Physics offers exciting research opportunities in theoretical and experimental condensed matter physics, astronomy and astrophysics, and soft condensed matter physics and biophysics.

Research in theoretical condensed matter physics focuses on the behavior of interacting quantum many-body systems with application to electronic, magnetic, optical, structural, and thermal properties of quantum materials. Basic research also includes the investigation of low energy scattering of atoms and molecules from surfaces and systems with many internal degrees of freedom, and the development of new methods for studying quantum many-body systems, such as new extensions of density functional theory to van der Waals systems. In addition, high performance computational techniques including quantum Monte Carlo and exact diagonalization are used to study strongly-interacting quantum systems with a focus on the types of emergent phenomena that are ubiquitous in complex systems. This includes investigations of entanglement in quantum fluids and gases in the presence of confinement, disorder, and dissipation.

The physics of recently discovered graphene and its derivatives is another major direction of theoretical research. These materials exhibit unconventional electronic, magnetic, mechanical, and transport properties, and efforts are under way to understand the role of quantum many-body effects both from fundamental standpoint and in relation to nanodevice and alternative energy applications. Other theoretical studies include strongly-correlated electron systems, such as complex oxides and high-temperature superconductors. Of particular interest are frustrated quantum magnets with novel ground states, as well as conducting cuprates which exhibit complex interplay of charge and spin phenomena. Such systems also tend to undergo quantum phase transitions, and the study of quantum critical phenomena is a major research direction.

Research in materials physics includes studies of the kinetics of thin film growth and surface processing, electronic, magnetic and optical response, applied to materials with interesting and useful physical properties such as organic semiconductors and magnetic materials. Many of the research projects involve real-time X-ray or electron diffraction structural studies of surface phenomena, sophisticated polarization and time-resolved spectroscopy imaging in high magnetic fields, combined with computer simulation of relevant surface processes. An ultra-high vacuum thin-film deposition laboratory on campus is dedicated to these studies, and regular use is made of national synchrotron X-ray facilities. The physics department hosts one of the few laboratories in New England where time-resolved, spin-dependent spectroscopy imaging at magnetic fields as high as 5 Tesla may be carried out.

Astrophysical research centers on experimental radio astronomy, with particular emphasis on pulsars and the interstellar medium. Observations are carried out using major instruments of the U.S. National Observatories and generally involve computer analysis and interpretation.

Research in biophysical ultrasound is directed toward an understanding of the physical principles involved when ultrasound interacts with living systems. This often involves collaboration with the College of Medicine. Acoustical and optical tweezers permit manipulating single cells without touching them. New forms of ultrasonic transducers and biosensors are being developed in collaboration with the Department of Electrical Engineering, as part of the Materials Science program. Biophysical research includes studies on the development and employment of novel uses of in situ atomic force microscopy for biological applications, specifically high- resolution structural studies of membrane proteins, investigation of the packing of genetic materials on bilayer membranes, and studies on how DNA-bilayer interactions affect the use of cationic lipids as gene-delivery means. Other research in biological physics and protein dynamics involves combining the detail of atomic-resolution X-ray crystallography with the sensitivity of optical and IR spectroscopy. The department has access to a state-of-the-art protein crystallography diffractometer and organizes

regular trips to synchrotrons in the U.S. and Europe.

Research in theoretical biological physics is focused on the use of coarse-grained, atomistic, and ab initio molecular simulation methods to understand the physical principles underlying the function of biological systems. Some research applications include lipid biomembranes, mechanosensitive channels, and enzymatic catalysis as well as understanding the connection between chemical structure and mechanical properties at the nanoscale. Researchers in the department have contributed to the development of local stress calculations from molecular dynamics simulation and its implementation in the GROMACS-LS and MDStress codes.

Opportunities for collaborative research with other university departments and groups include those with Chemistry, the Materials Science program, Molecular Physiology and Biophysics, the Cellular, Molecular and Biomedical Sciences program, Computer Science, Electrical Engineering, Bioengineering, Civil and Environmental Engineering, Mathematics, Mechanical Engineering, Medical Radiology, and Geology.

II Exact wording of degree to be awarded

Doctor of Philosophy (Ph.D.) in Physics

III Rationale for the Program

III.A Philosophical goals

Vermont is currently the only state in the country without a Ph.D. program in physics [1] and local enthusiasm and capital investment in Science, Technology, Engineering and Mathematics (STEM) at UVM makes this an ideal time to seek its reinstatement. Currently, our best Physics M.S. students who are interested in pursuing the most advanced degree in their field must leave the state, promoting a *brain drain* effect that may have a considerable negative effect on the economical competitiveness of Vermont [2].

Physics is one of the most fundamental natural sciences. Principles, laws, and ideas from physics provide the basis for understanding concepts in the chemical and biological sciences. In addition, physics plays a central role in a variety of interdisciplinary fields, including engineering, materials science and medicine. The interconnectedness of physics and the ability to develop a quantitative description of scientific concepts places physicists in a unique position to interact with many fields. This situation is reflected at the University of Vermont; faculty members in Physics are affiliated with the Structural Biology and Bioinformatics Facility, Computer Science, Mechanical Engineering, Materials Science and Cell and Molecular Biology. Research collaborations exist between physics faculty members and investigators in other colleges, including the College of Agriculture and Life Sciences, the College of Engineering and Mathematics and the College of Medicine.

Physics also provides the basis for technological development, impacting a broad section of the workforce in a modern society. The majority of physics Ph.D.s are employed outside of academia in industry, federally-funded research centers and agencies, national labs, non-profit research institutes and hospitals. Physics training is of considerable value for many different professions because it fosters development of general analytical skills that are useful in a variety of career choices. This value is also realized in the role of Physics in the economic development of a community. A more sophisticated department and active faculty means more colloquia and seminars open to local industry, more faculty expertise upon which to call, more faculty consulting helping local

manufacturers, internships and patents. Faculty working with industrial colleagues can play a large role in economic development. Locally, employers such as IBM and GlobalFoundries have hired numerous graduates of UVM's Physics M.S. program and their employees have benefited from graduate level classes taught in the department. UVM Physics students have been admitted to doctoral programs at top-tier research institutions, including Stanford, Dartmouth College, Massachusetts Institute of Technology, the University of California, the California Institute of Technology and the University of Illinois.

The Master of Science in Physics is the principal graduate program of the Department of Physics and is currently the only physics graduate program in the state of Vermont. This program has had and continues to have an excellent national and regional reputation for the high quality and accomplishments of its graduates. In 2001 the American Institute of Physics ranked UVM among the top 20 professional physics Master's programs in the nation. A critical feature of the M.S. in Physics is a thesis involving original research in one of the areas of specialization of the department, namely astrophysics, medical physics, biological physics, condensed matter physics, and materials science. The M.S. program enrolls a strong group of students who get excellent training and go on to productive careers in science and research.

III.B Objectives

The Physics Ph.D. program at UVM will train a new generation of students to attack some of the most critical problems facing our world. Successful graduates will become future scientific leaders in industry and the academy and will be experts in experimental, computational and theoretical physics. Specific emphasis will be placed on how the skills that graduates learn in the Physics Ph.D. program can be applied to complex and interdisciplinary challenges in technology, materials design and renewable energy.

The specific goals of the Ph.D. program are:

1. Provide students with a diverse and deep understanding of the core subjects underlying all research in modern physics including: classical mechanics, quantum mechanics, statistical mechanics, electrodynamics, many-body physics, computational and experimental methods.
    - *Assessment Metric:* Students will be required to pass a comprehensive examination in year two of the program ensuring they have a suitable grasp of the core subjects.
2. Graduate exceptional students who will excel in careers in industry and the academy.
    - *Assessment Metric:* Expectation of multiple publications in high profile journals, invited and contributed talks, high quality dissertations and tracking of jobs post-graduation.
3. Enhance collaborative research in the College of Arts & Sciences at UVM
    - *Assessment Metric:* Number of students co-advised with non-Physics faculty members, diversity of faculty serving on student thesis committees and publications written with colleagues across departments and colleges.
4. Increase the number of under-represented minorities (URM) with a Ph.D. in Physics.
    - *Assessment Metric:* Continue and extend our partnership with the Bridge Program of the American Physical Society [4] and track the number of URM students who successfully graduate from the program.

Through the achievement of these goals we will have corrected the long standing position of Vermont as a state not offering the highest academic degree in Physics, trained a new generation of highly skilled physicists, aided in boosting jurisdictional capacity and contributed to the economic success of the region. Moreover, we will have enhanced the research capabilities of Physics faculty and produced a group of alumni with a high potential for future success and engagement with the Physics Department and UVM.

IV Relationship of this Program to Current Mission and Long-Range Plans

IV.A Participating departments, programs, schools, and colleges

The current proposal for a Ph.D. Program in physics stems from a fundamental need to build capacity and strength in the *fundamental* physical sciences at Vermont's flagship university.

There is a correlation between the number of undergraduate Physics majors enrolled in B.S. or B.A. program and the highest degree offered by the department. In particular, data collected by the American Institute of Physics has shown increases by as much as 40% [3], and thus the Ph.D. program could aid in the mission of the Physics Department to increase the number of graduating majors by 50% in the next five years. There are currently a total of 60 physics majors at UVM. This represents a sustained growth from 35 majors in 2013, indicating a strong contemporary interest in physics among UVM's undergraduate population. The increased research and teaching opportunities that come with the new STEM complex and the Physics Ph.D. program will help sustain this growth through the next five years to meet UVM's STEM targets [8].

Additionally, the availability of highly accomplished graduate student researchers in physics will increase the ability of faculty participating in the Ph.D. program to take on and advise undergraduate students to work on cutting edge research problems. These research opportunities are now seen as an essential competitive advantage for prospective students, and they are known to contribute to enhanced retention of Physics majors in the undergraduate program [9]. This is especially true when attempting to engage and retain those students who are typically underrepresented in the physical sciences [10]. Thus the new research opportunities offered by the Ph.D. will actively contribute to the College of Arts & Sciences' (CAS) *Commitment to Diversity* as well as their argument that the:

> *Study of the physical world and its phenomena is strengthened by the accessibility of our faculty and excellent research facilities. In addition to traditional learning in classrooms and laboratories, many opportunities exist for undergraduates to engage in independent or faculty-guided research.*

For non-Physics majors that experience Physics at UVM through our substantial service-teaching duties to students in CAS, CEMS and CALS pursuing STEM degrees, the prevention of attrition and a reduction of Drop-Fail-Withdraw (DFW) rates will be addressed by the Physics Ph.D. program through the involvement of graduate students on TAs in our new teaching pedagogy initiative. As we transition to the new STEM facility on campus, our custom-designed active learning classrooms will employ the SCALE-UP (Student-Centered Active Learning Environment with Upside Down Pedagogies) instruction method [11]. This approach has been shown to drastically improve student performance and success at some of our aspirant institutions and heavily involves GTAs in the classroom.

Other major research units and groups on campus will strongly benefit from the possibility of collaborating with Physics Ph.D. students, including the Vermont Complex Systems Center that

already includes associate members from Physics.

IV.B The University

In the 2013/2014 UVM President's Annual Report, he outlines his vision for "Building a future in Science, Technology, Engineering and Mathematics (STEM)" disciplines on campus, and argues that they are "essential to creating solutions to the Grand Challenges identified by the National Academies." In light of this, it appears that the creation of a Physics Ph.D. program at this time is absolutely crucial to the vision, mission and future success of the University of Vermont.

V Relationship to programs offered currently.

The program most likely to be affected by a Physics Ph.D. program would be the Physics M.S. program and Materials Science Ph.D. program.

- **Physics M.S.:** This program would be recast as a terminal option for self-supported professional students or those students admitted to the Ph.D. program who fail to demonstrate suitable progress towards the Ph.D. degree within the first three years. The pools of applicants for a terminal Physics M.S. and Ph.D. degree are known to have non-overlapping career objectives with the former appealing to students wishing to either (1) prepare for a Ph.D. program by gaining research experience or (2) develop a new technical skillset in demand by employers.
- **Materials Science Ph.D.:** This stand-alone program is of high national and international interest with a successful track record of extramural funding and high-impact-factor publications that will contribute to attracting high quality students at UVM. The two programs are complementary and appeal to students with different backgrounds and career goals. Given the relatively small size of both programs, each will benefit from the success of the other. Sustainable growth in interdisciplinary research will be enhanced by the new synergies enabled by the Physics Ph.D. program. Physics will continue to commit at least three GTA lines to Materials Science, in tandem with a similar contribution from the other participating units (Chem, ME, CE, EE). We anticipate that Physics faculty will continue to advise Materials Science Ph.D. students in parallel, as much of the research in the department involves topics pertaining to materials physics.

VI Indicate any other programs at the University which are similar in title or content and illustrate how they may overlap or differ.

There are no other substantially similar programs currently offered at UVM.

UVM offers several Ph.D. programs in STEM disciplines, including Chemistry, Bioengineering, Civil & Environmental Engineering, Electrical & Biomedical Engineering, Mathematics, Mechanical Engineering, and Materials Science. Materials Science is an interdisciplinary program that includes elements of Chemistry, Physics, and multiple branches of Engineering, allowing for course and research flexibility tailored to various student interests and backgrounds. It overlaps no more with Physics than it does with Chemistry or Engineering. Introducing the Physics Ph.D. program at UVM will balance the strength of the pillar disciplines of Materials Science, allowing the program to more truly reflect its interdisciplinary nature.

Institution	N.E.†	Peer‡	Asp.*	Tenure-track Positions	Graduate Students	Highest Degree
U. Vermont	✓			10	16	M.S.
U. Mass, Lowell	✓			19	61	Ph.D.
U. Mass, Amherst (Astronomy)	✓			18	20	Ph.D.
U. Mass, Amherst (Physics)	✓	✓		28	86	Ph.D.
U. Connecticut	✓	✓		27	81	Ph.D.
U. Maine	✓	✓		14	42	Ph.D.
U. New Hampshire	✓	✓		24	60	Ph.D.
U. Rhode Island	✓	✓		11	21	Ph.D.
U. Delaware		✓		36	78	Ph.D.
Kansas State		✓		28	57	Ph.D.
SUNY Albany		✓		15	61	Ph.D.
SUNY Binghamton		✓		15	37	Ph.D.
Miami University		✓		17	26	Ph.D.
Clemson U.		✓		22	66	Ph.D.
Washington State U.		✓		17	70	Ph.D.
Boston College			✓	18	48	Ph.D.
Dartmouth College			✓	21	54	Ph.D.
Tufts University			✓	19	24	Ph.D.
U. Colorado			✓	59	225	Ph.D.
U. Michigan			✓	73	140	Ph.D.
U. North Carolina			✓	30	120	Ph.D.
Penn State (Astronomy)			✓	21	31	Ph.D.
Penn State (Physics)			✓	49	116	Ph.D.
College of William & Mary			✓	28	66	Ph.D.
U. Virginia (Astronomy)			✓	18	34	Ph.D.
U. Virginia (Physics)			✓	35	84	Ph.D.
U. Wisconsin (Astronomy)			✓	12	26	Ph.D.
U. Wisconsin (Physics)			✓	47	177	Ph.D.

†New England State University
‡ Peer institution.
*Aspirant institution.

Table 1: Number of tenure-track positions, graduate students and highest degree offered at the New England State Universities, Peer Institutions and Aspirant Institutions, as reported to the American Institute of Physics [1]. All listings are for Departments of Physics and Astronomy, except where noted. Peer & Aspirant institutions are determined by the UVM Office of Institutional Studies [17].

VII Comparable Programs at Reputable colleges and universities

A list of programs comparable to the proposed Ph.D. program are outlined in Table 1.

VII.A What are the highlights of these programs and how do they compare with the projected program at UVM?

There exist, within the Northeast and nationwide, a number of graduate physics programs of different sizes and research focus. A sample of such programs is shown in Table 1, where our neighbor New England universities are particularly highlighted. It is generally common for the

larger institutions to have faculty in many branches of physics and thus award Ph.D. degrees to physicists who enter the academic and industrial workforce with expertise in many subfields of physics. However it is the norm in the majority of the medium/small US physics departments to have research focus centered around their particular needs. For example within our immediate geographical neighborhood this is the case at Univ. Maine, Dartmouth College and Univ. of New Hampshire, where there exist strengths in the fields of space physics, cosmology, astronomy, biophysics, atomic and surface physics. Our proposed program will provide education and research opportunities in additional and uniquely different directions, specifically condensed matter and materials physics, which will make it attractive to students within our region and worldwide.

The proposed program at UVM will have a unique research focus, centered around world-class expertise in the following active areas of physics, currently experiencing exponential research growth: 1. Condensed matter physics, both experimental and theoretical, with particular emphasis on: (a) Organic electronics and solar cells, (b) Novel two-dimensional, atomically thin electronic materials, (c) High magnetic field optics, (d) The physics of quantum information and computation, (e) Cutting-edge X-ray spectroscopy, (f) Atomic physics near novel material surfaces, (g) Novel types of correlated and superfluid systems, (h.) Advanced numerical techniques for strongly correlated materials and biophysical systems, 2. Biophysical Acoustics, and 3. Pulsar Astrophysics. This blend of interconnected research expertise will make the new Ph.D. program attractive and unique in the New England region and beyond, and it provides the graduate students with competitive advantages for jobs both in academia and industry. Through targeted growth in regionally underrepresented areas of physics that are in high demand we expect Vermont to rapidly and effectively compete for the best students with our peer and aspirant institutions.

VII.B Do universities engaging in regional participation with UVM offer these programs?

There are no universities in the State of Vermont that offer a Ph.D. degree in Physics. Other institutions in New England offer comparable programs as discussed above.

VIII Evidence of communication with academic units likely to be involved in or affected by the program.

VIII.A Indicate the effect the program will have on other academic units

Many departments and colleges require physics courses as part of their degree or as prerequisites for certain courses. Most notably, pre-med and engineering students (roughly 300 annually) require at least two semesters of physics. The proposed Physics Ph.D. program will bring an increased number of physics students who will staff the active learning classrooms, designed specifically at helping these students succeed. Active learning pedagogies have been shown to significantly improve student outcomes by integrating many hands-on activities during class that engage students to better learn concepts. Active learning is facilitated through group discussions in real-time by graduate teaching and undergraduate learning assistants.

VIII.B Dean and chairperson/program director support

Letters of support are attached from:

- Richard Galbraith, Vice President of Research

- William Falls, Dean, College of Arts & Sciences
- Rick Morin, Dean, Larner College of Medicine
- Luis Garcia, Dean, College of Engineering & Mathematical Sciences
- Physics Department Response to Dean Garcia's Letter
- Nancy Mathews, Dean, Rubenstein School of Environment and Natural Resources
- Madalina Furis, Program Director, Materials Science Program
- Jun-Ru Wu, Chair, Department of Physics, CAS
- Chris Landry, Chair, Department of Chemistry CAS
- Sarah Helms Cahan, Chair, Department of Biology, CAS
- Yves Dubief, Interim Chair, Mechanical Engineering, CEMS
- David Warshaw, Chair, Department of Molecular Physiology and Biophysics (MPB, LCOM)
- Adrian Del Maestro, Director Vermont Advanced Computing Core
- Kate Kirby, American Physical Society Executive Officer

IX Evidence of Demand or Need For Program

The pressing need for this program can be seen from a number of sources:

- **Statistics from National and Local Peer Institutions:** The American Institute of Physics tracks the number of applications, the number of accepted students, and the number of students who enroll in physics graduate programs.[5] In all national programs for which AIP keeps data in 2016, there were 29,446 applications of which 6,634 were accepted. While some of the applications were certainly duplicates, this represents a national average acceptance rate of 22.5%. A closer look at UVM's peer institutions in New England (University of Maine, University of Massachusetts Amherst, University of Connecticut, and University of New Hampshire), 120 of 328 applications were accepted (36.6%), and 42 students enrolled in Physics Ph.D. programs. There is a clear demand to study physics at the Ph.D. level at state universities in New England. Because of the strength and reputation of UVM as a whole, and the UVM Physics Department's specific focus on condensed matter physics, astrophysics, and biophysics (three of the top five subfields for Ph.D. degrees)[6], UVM will be very competitive in attracting qualified students from the existing pool, and will likely attract more applicants who otherwise would not have sought to study in New England.
- **Job Market for Physics Ph.D.s:** There is a clear demand in the private, public and academic sector for Physics Ph.D students. Details are provided in § X.F.
- **University of Vermont research**. The proposed Ph.D. program will complement and assist other areas of the university in their research efforts. For programs such as Materials Science, the cooperation will enhance an already strong research program. For departments without existing Ph.D. programs, this cooperation may enable new levels of research to be undertaken. We expect the proposed Ph.D. program to attract a significant number of graduate students from different disciplines and further promote external funding opportunities.

- **Competitive Universities**. Of the six New England State Universities, all but UVM offer a Ph.D. in Physics. Of the fourteen Peer Institutions identified by the UVM Administration, twelve offer a Ph.D. in Physics. All of the Aspirant Institutions identified by the Administration offer a Ph.D. in Physics.

- **Attractive Environment**. UVM is able to compete with top-tier Physics programs in undergraduate recruitment due to the quality of life and nearby recreation opportunities in the Burlington area. We expect this attractive element to carry over to our Ph.D. program recruitment.

- **Faculty Recruiting and Retention**. The Ph.D. program is essential to attract and maintain a strong faculty in the Department and also in other departments in the University that can benefit from the proposed Ph.D. program. The lack of a Ph.D. program hampers our attempts to attract new, high-quality candidates to the Department. *We see the creation of a Ph.D. program in Physics as critical to establishing a strong and stable faculty in the Department.*

- **Funded Research**. The absence of a Ph.D. program hinders the opportunities for funding, with some grants being (either explicitly or implicitly) limited to Ph.D. granting institutions. Faculty with existing grants have been forced to fund students through other departments or other institutions to complete their research. We expect that the proposed program will help the Department and the University promote sponsored research.

- **Existing faculty demand**. As demonstrated in the attached CVs of our graduate faculty members, our faculty are involved in the forefront of research in Astrophysics, Biological Physics, Medical Physics, Condensed-Matter Physics and Materials Science. We publish in top-tier journals and conferences in our research areas, edit prestigious journals, participate on national funding review panels, and play significant roles (such as steering committee, conference committee and program committee chairs) at important international conferences. UVM Physics faculty are currently serving as PI's (6) and co-PI (1) on a total of 7 active, externally funded research grants totaling over $3,000,000. The Department is confident that we will be able to offer a high-quality Ph.D. program in Physics at UVM.

- **Active Learning Classrooms**. As part of a plan to decrease attrition and increase retention in undergraduate STEM degree programs on campus the Physics Department will transition to Active Learning pedagogy [11] in September 2018 in many of our service teaching classes. This includes ASTR 005, 023, 024, 051, 053, 055, and 057, PHYS 009, 011, 012, 013, 021, 022, 031. The success of this endeavor hinges on our ability to involve Ph.D. students with strong Physics background in the classroom to achieve the optimal 1:18 ratio demonstrated to effect learning gains.

In summary, a Ph.D. program in Physics has a strong demand from students, faculty and potential employers. Adding the program should strengthen research and teaching at the University across a broad range of disciplines as well as maintain and enhance the institution's reputation amongst potential students and peer institutions. The program should also become a focal point for attracting additional research funds to the University.

For a brief historical perspective, UVM offered a Ph.D. in Physics from around 1967 to 1974. In 1974, UVM experienced a financial emergency, and a number of Ph.D. programs were eliminated. These include the Physics Ph.D. and the Mathematics Ph.D. The UVM Football team was also cut at the same time. Physics was a new Ph.D. program that was not adequately funded in the

early stages, and was therefore a relatively easy choice to cut at the time. Much has changed for STEM disciplines since then. In 1994, UVM successfully reinstated the Mathematics Ph.D. program, which ultimately led to the success of the Complex Systems program. A disciplinary expertise led to a highly impactful interdisciplinary program. Now, the national and local interest, combined with recent investment in STEM infrastructure, render UVM prime to become a regional leader in STEM fields. To do so will require the offering of the standard terminal degree in Physics, the foundational STEM discipline. Based on our departmental history, and knowledge of programs throughout the country, adequate resources during the initial growth phase of the program are crucial for its success and sustainability.

IX.A Indicate justification of inauguration of program at this time:

Over the past several years, the academic, curricular and research productivity of the department has grown rapidly. The improvements in Physics are due to a combination of focused faculty hires in growth areas, improved student quality and a revitalization of research within the department. Recent progress in the Physics Department has included a 50% increase in majors over the past five years and we project an additional increase of 50% over the next five years. [14].

There is currently no doctorate offered in Physics at UVM, although Physics faculty participate in the Materials Science and the Cellular, Molecular and Biomedical Sciences (CMB) Ph.D. programs. A Ph.D. in Physics will complement existing graduate programs, develop new research opportunities and help strengthen scientific collaborations. Such a degree offering is in line with UVM's projected growth - a comparison with other institutions reveals that almost all of UVM's regional and academic peer institutions have larger, doctoral-granting Physics programs. These data are summarized in Table 1.

The American Institute of Physics has regularly reported information about physics and astronomy graduate students since 1968. The most recent report [12] indicates that enrollments in Physics Ph.D. programs are at the highest levels in a decade. For U.S. students, the most popular physics subfield is astronomy and astrophysics, followed by condensed-matter physics. For foreign students, the most popular field is condensed-matter physics. UVM has a focus in both of these fields.

- The 2015 American Institute of Physics listing of graduate programs reveals that of the fifty states and the District of Columbia, Vermont is unique in having neither a public nor private institution Physics department with a doctoral-level degree [1].
- Of the New England state universities, only the University of Vermont has no Ph.D. program in Physics. The unique regional research strengths of the UVM Physics department, combined with many academic and geographic advantages will make our program immediately competitive for recruiting and retaining top quality students.
- All of our aspirant institutions offer a Ph.D. in Physics.

With the large investment in STEM infrastructure on campus and our impending move to brand new research and teaching facilities this is an opportune time to invest in a Physics Ph.D. program at the University of Vermont.

IX.A.1 Explain education, personnel needs, and social needs that exist (refer to specific authorities or studies consulted);

Physics lies at the heart of STEM education and research. The case for STEM demands a solid foundation in physics, and the Ph.D. program is integral to training all levels of students, both in

physics and in related STEM fields, to tackle the 21st century global problems. The case for the educational, personnel, and social needs has been elegantly stated by both former President Barack Obama [7], and by UVM Provost David Rosowsky [8].

> "One of the things that I've been focused on as President is how we create an all-hands-on-deck approach to science, technology, engineering, and math... We need to make this a priority to train an army of new teachers in these subject areas, and to make sure that all of us as a country are lifting up these subjects for the respect that they deserve."
>
> – Barack Obama [7]

> "As Vermont's public research university, we have an obligation to step up - and we are both prepared and excited to do so. We have deep applicant pools in the STEM disciplines, with some of the most well qualified students. If we make it a priority and redirect existing resources and strategically invest new resources, we can double our STEM enrollment."
>
> – David Rosowsky [8]

The case for STEM education is clearly a national and local priority, and physics is a foundational component of nearly all subfields of STEM.

IX.A.2 Anticipated enrollment

The ramp-up schedule of the Physics Ph.D. program is based on knowledge gained from similarly sized departments who have recently implemented Ph.D. programs (e.g. UMass Boston) in combination with current inquiries to the department and lessons learned from the very successful Materials Science Ph.D. program. Our current Physics M.S. program graduates between one and two students per year. National statistics indicate that M.S. degrees in Physics from terminal master's programs represent only 7% of all graduate degrees in physics.[20, 21] 93% of students wishing to pursue degrees in physics (generally speaking the top students) prefer to enter Ph.D. programs, and 76% of those students successfully complete their Ph.D. While simple statistics indicate that we could anticipate a ten-fold increase in our Physics graduate program size by offering a Ph.D. degree, we do not over-project our growth scenarios.

We anticipate two stages of the program, an initial "startup phase" which will admit 4 students every other year until we have secured additional GTA lines and an additional TT hire promised in the CAS Strategic Plan. At this point, we will move to the "sustainable phase" where we hope to admit 3 students per year keeping the total number of students in excess of 20. In the long term, we anticipate that 13 of these students would be supported via GTAs to support our departmental teaching needs, while the remaining students would be supported via GRAs on extramural grants.

IX.A.3 Indicate how this program will meet local and regional needs

High-technology has become one of Vermont's key industries along with agriculture, health and tourism. The State of Vermont does not have a Ph.D. program in Physics. IBM, the largest private employer in this state, has obvious interest in the Physics program, as already evidenced by both the fact that a significant number of our Master's level students are employed at IBM and the number of IBM employees taking Physics courses. In addition, local technology companies have a significant second interest in the Ph.D. program: the availability of a local graduate program in physics is a positive factor in employee recruiting. We firmly believe that a Ph.D. program in Physics at UVM will help the State of Vermont attract more high-tech industry to bolster its economy.

IX.B Number of Physics M.S. Graduates

Data collected since 2011 shows that the Physics M.S. program graduates between 1-3 students per year, consistent with the number of GTAs (2) allocated to the program. The M.S. program was ranked by the American Institute of Physics as being in the top 20 of national professional physics Masters programs. Alumni have consistently gone on to be accepted in premiere Ph.D. programs and earning senior positions in industry.

X Students

X.A Source of candidates:

Students' interest in physics has grown rapidly not only here at UVM, but also nationally. The most recent AIP report on undergraduate physics majors indicated that the number of Physics majors nationwide has increased by 12% and the number of Astronomy majors has increased by 30% in the last 15 years [12]. The number of Physics majors at UVM grew by 100% over that same time period, doubling from 30 to 60. UVM does not currently offer an Astronomy major, but launched an Astronomy minor in 2012 which is rapidly growing as well. Both current UVM students and students from other programs frequently inquire about the possibility of a Ph.D. program in Physics. Graduates of the Physics Department at UVM are highly sought after by well-known companies and academic organizations. Our undergraduate students go on to strong graduate programs when they choose to do so. Each has a variety of employment offers locally and nationally. Our M.S. students have a variety of career options after graduation. Students attracted to the Physics Ph.D. program will come from a different pool of candidates, compared to our M.S. students, which are interested in directly starting a doctorate degree after completing their Bachelor's.

UVM Physics is currently in the process of becoming an affiliated member of the Bridge program [4] of the American Physics Society (APS). This program aims to increase the number of physics Ph.D.s awarded to underrepresented minority (URM) students, including African American, Hispanic American, and Native American students. The program has been very successful in matching students with prospective institutions using a more holistic approach to admissions (i.e. not simply cutting off candidates on the basis of GRE scores). The project has established six bridge sites in Indiana, Ohio, Florida, and California that provide coursework, research experiences, and substantial mentoring for students who either did not apply to graduate school, or were not admitted through traditional graduate school admissions. One of us (Valeri Kotov) recently attended a Bridge program conference (February 2017 in College Park, MD), as part of the Physics department's commitment to diversity, and we will shortly visit institutions who have achieved considerable success in graduate recruiting. In particular we will visit California State University, Long Beach, by invitation of the Physics Chair Prof. Andreas Bill. We have made numerous contacts with the Bridge program leadership at the APS, as well as faculty members who administer the program at several universities, and expect to take full advantage of the Bridge project once our Ph.D. program starts.

We expect to attract an international and diverse pool of students interested in pursuing a Ph.D. degree in physics that is considerably larger than those interested in our terminal M.S. program due to the additional opportunities the higher degree provides. Our proposed admittance numbers are based on the current inquiry rate combined with domain-specific knowledge in the New England region.

X.B Requirements for admission and retention of students:

Applicants are expected to have a B.S. degree in Physics or a related field and will be admitted by a selection committee (see below). The Physics department has well-defined procedures and substantial experience in selecting undergraduate students for graduate work, within the current Physics MS program as well as through the Materials Science graduate program. Once in the Ph.D. program, the students will be expected to pass a qualifying examination and maintain 3.0 GPA as well as show sufficient progress in their research from year to year.

X.C Selection process

The admissions process is fairly standard and will be administered by an admissions committee which will involve several faculty members. Evaluation of candidates will be based on GPA averages as well as on GRE (general) scores, combined with the candidates interests and potential fit with the research of faculty members in our department. We will aim to have a personal interview and a visit to campus (which will involve meeting with current graduate students) if possible; if this proves impossible, especially for overseas candidates, we will conduct an interview via Skype. Previous experience shows that a good fit both in terms of potential research interests and also overall, within the academic and town community, is absolutely essential for the graduate student's success; thus we will strive to achieve it.

X.D Financial support available through the department and expected from the Graduate College or other UVM sources (Graduate Programs):

Under the incentive-based budget (IBB) model, CAS will be responsible for resources to support the program. The current algorithm for graduate education gives 100% of the tuition to the unit in which the doctoral student's program resides. This applies to students supported by GRA positions on extramural grants. For current faculty, there will be course adjustments as their responsibilities shift towards research mentoring of graduate students and teaching of the proposed new program courses. The Dean's office, department, and programs will work collaboratively to fund these course changes.

X.E Mechanism of advising students:

The Physics Graduate Committee will be responsible for development of individual plans for each graduate student and following on their progress throughout their graduate career. The Committee will be in close contact with the Graduate Advisor, who will be advising the student in his/her research: select a research topic, make sure they develop the necessary skills, take the right courses, etc., and then direct the actual research work. The Program Director will receive reports periodically on the progress of the graduate students. In particular, graduate students will receive guidance in the following: (a) fulfilling the necessary requirements, including coursework, qualifying exam, etc, (b) exploring their academic interests and talent, thus choosing the appropriate sub-field of physics, which will typically (but not always) be their subfield for the rest of their academic careers, (c) exploring post graduation employment. The Physics department is committed to helping students explore deeper their chosen area of study and the opportunities associated with it. As nationally and internationally-known scholars with successful careers in the sciences, our faculty members have a wealth of expertise as well as extensive collaborative networks that can be accessed and leveraged by our students. Once the Thesis defense stage is in sight, approximately one year out, a thesis committee will be formed. The Thesis Committee will be made up of at least

4 members of the graduate college faculty. At least two members must be a part of the primary program of study (physics). The chairperson of the Thesis Committee must be a graduate faculty member outside the Physics Department.

X.F Prospects for employment or opportunities for further education of graduates

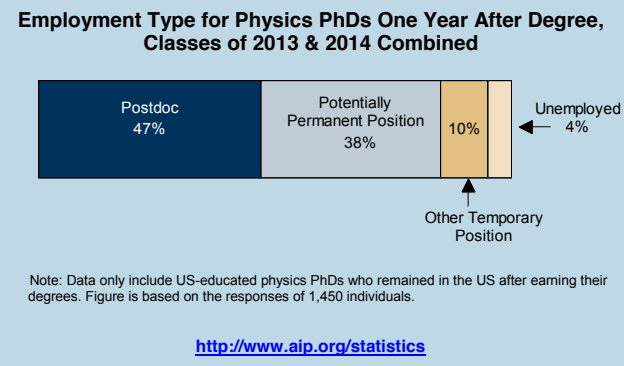

Figure 1: Employment opportunities for Physics Ph.D. graduates.

Historically, physicists have been employed in a broad array of different careers throughout the economy. The majority of physics Ph.D.s (about 25,000) are employed outside of academia in industry, federally funded research centers, federal agencies, national labs, nonprofit research institutes and hospitals. Over the past decade, the physics job market has steadily improved, with much of the growth due to the high-tech industry and a reaffirmation on the part of business, industry, government and academia of the important coupling of science and technology to the health of the economy. Physicists are increasingly being lured into a variety of fields including software and consulting. There is an especially strong demand for people with scientific and technological skills. Physicists have benefited in this current employment market.

In assessing the job market for Physics Ph.D.s, a variety of recent statistics and indicators show the current physics job market to be very positive. These statistics follow the possible outcomes upon graduation and compensation for successful job applicants.

- *Unemployment rate:* Unemployment among Physics Ph.D.s six months after degree is below 4% (see Figure 1).
- *Salary:* The median starting salary for all Ph.D.s in Physics is $100,000 in the private sector and $65,000 in the academy. Salary data are summarized in Table 2 [13].

XI Programs of Study

XI.A Programmatic Quality and Excellence

XI.A.1 Describe the coherent body of knowledge and skills, and the specified set of learning outcomes, that the program seeks to foster.

Physics is concerned with the mathematical formulation of the fundamental laws of nature. It is the most fundamental science and lies at the heart of all natural science, technology, and engineering.

%	Position	Salary ($k)
39	University (PostDoc)	42 – 55
13	University (Permanent)	50 – 68
31	Private Sector	80 – 108
14	Gov. Lab (PostDoc)	59 – 73
3	Other	Variable

Table 2: Typical starting salaries for Physics Ph.D.s, 2013 & 2014 combined.[13]

The Ph.D. program in physics will prepare students to **independently conduct state-of-the-art physics research**. To that end, this program seeks to foster a deep knowledge of core physics concepts and discipline specific physics topics. It will emphasize training of the Ph.D. candidates in the skills necessary to conduct research in theoretical, computational, and experimental physics. This training begins with the formulation of a hypothesis driven research proposal, encompasses myriad research techniques, and culminates with the dissemination of information through presentations and peer-reviewed publication.

Physics graduate education is markedly distinct from physics undergraduate education. Graduate courses in Physics require a level of mathematical sophistication not found in most undergraduates and traditionally consists of *core courses* that prepare students for a Ph.D. qualifying exam and *specialty courses* that focus on specific topics in Physics.

XI.A.2 Discuss progression of students through the curriculum, with attention to the developmental sequencing of courses and scaffolding of student knowledge and skills.

The general progression through the physics Ph.D. program will begin with two years of intensive coursework, including the core and breadth requirements. At the end of the second year, the candidates will be required to pass a qualifying exam, demonstrating their mastery of the physics content. Questions will be prepared to cover all of the core areas (which will be required for all students) and the relevant breadth topics (students must select the questions of their choice). During the first two years, students will be expected to seek a research advisor among the physics faculty. Upon successful completion of the qualifying exam, the Ph.D. candidate will take Doctoral Dissertation Research (PHYS 491) credits for the remainder of their study. Students entering the Ph.D. program will begin begin initially be supported on graduate teaching assistant fellowships (GTAs). This allows the students to focus on coursework for the first years. However it is expected that they transition to graduate research assistantships (GRAs) provided funding is available. This is a standard model for graduate programs in most physical sciences. Though a GTA and GRA have the same nominal time commitments, the schedule of a GTA fits seamlessly into a typical first-year course load for Ph.D. students whereas a GRA often requires visits to beam-lines or other national lab facilities and conducting time-critical experiments that can interfere with homework and class schedules.

A Ph.D. candidate will be required to propose a thesis topic (thesis proposal) by the end of their second year in the program. This process includes a written and an oral presentation component, to be evaluated by the thesis committee. A Ph.D. thesis in physics must represent a significant and new contribution to the relevant field of research. Once the candidate has completed the proposed research, they will write their findings in a complete thesis and defend the thesis in an

oral presentation to the general public and the thesis committee. The committee will then examine the candidate's understanding of physics, and of the specific topics, according to the standard procedures of the UVM Graduate College.

Completion of a Ph.D. in physics is not bound to a specific timeline, but rather is evaluated by the contribution to progress of research in the field. However, we are aware that several issues must be monitored to assure student progress through the Ph.D. program. It is expected that the entire Ph.D. process will take, on average, six years to complete, consistent with norms in the discipline. There will certainly be variation in the research output of individual students, and this timeline could vary from four to eight years easily. There are very legitimate personal and scientific reasons for this process to take longer or shorter than expected. Therefore, the UVM Physics faculty will, once a year, evaluate the progress of each Ph.D. candidate and provide advice to both the student and the research advisor if needed.

XI.A.3 Address both curriculum breadth and depth.

A Ph.D. in physics represents a highly specialized and in-depth study of a particular physical phenomenon. The research is cutting-edge by nature, and completion of the Ph.D. thesis leaves the candidate as the foremost global expert on the specific topic of their work. However, a Ph.D. in physics also represents a solid foundational understanding of the general principles of physics. Therefore, the coursework-based curriculum described below includes a rigorous set of required core courses, and a series of discipline specific electives.

XI.A.4 Describe the academic rigor of the program and practices that lead to high expectations for student learning.

Individual courses will be conducted at the highest level of academic rigor. Each student must pass all core and elective courses with a grade of B or higher. A comprehensive exam will evaluate the cumulative student learning at the end of the second year of the program. Students will be trained in all aspects of research skills, and will be subjected to the highest level of academic rigor, publishing their research through the peer-review process. A successful candidate in the Physics Ph.D. program will be expected to publish multiple peer-reviewed articles prior to completing their degree.

XI.B Indicate all courses to be included in the program:

XI.B.1 Core courses

Based on a study of the Ph.D. curriculum of both peer and aspirant institutions, all Physics Ph.D. students will be required to take six core graduate courses:

- PHYS 214 - Electromagnetism (3 credits)
- PHYS 301 - Mathematical Physics (3 credits)
- PHYS 311 - Advanced Dynamics (3 credits)
- PHYS 313 - Electromagnetic Theory (3 credits)
- PHYS 362 - Quantum Mechanics II (3 credits)
- PHYS 365 - Statistical Mechanics (new course, 3 credits)

All of these courses must be completed with a grade B or better within the first two years of graduate study. We will base a written Ph.D. qualifying examination on the material from these courses.

XI.B.2 Elective courses

To accommodate the needs of the specific subfields in physics such as astrophysics, biological physics, condensed-matter physics and materials physics, any three of the courses listed below can be chosen to fulfill the breadth requirement with a grade of B or higher. Elective courses must be completed within the first three years of the program, as the fourth year (and beyond if needed) should be dedicated to progress towards the Ph.D. thesis.

Physics

- PHYS 222 - Biological Physics (3 credits)
- PHYS 242 - Introduction to Solid State Physics (3 credits)
- PHYS 256 - Computational Physics (3 credits)
- PHYS 257 - Modern Astrophysics (3 credits)
- PHYS 258 - Relativity (3 credits)
- PHYS 264 - Nuclear and Elementary Particle Physics (3 credits)
- PHYS 305 - Teaching of College Physics (3 credits)
- PHYS 321 - Theoretical Physics (3 credits)
- PHYS 323 - Contemporary Physics (3 credits)
- PHYS 341 - Solid State Physics (3 credits)
- PHYS 351 - Physics of Materials (3 credits)
- PHYS 356 - Computational Physics II (new course, 3 credits)

Others

- ME 336 - Continuum Mechanics (3 credits)
- ME 350 - Multiscale Modeling (3 credits)
- MPBP 323 - Biophysical Techniques (4 credits)
- CHEM 260 - Advanced Physical Chemistry (3 credits)
- BIOC 301 - General Biochemistry I (3 credits)
- BIOC 302 - General Biochemistry II (3 credits)

In addition, Doctoral Dissertation Research (Physics 491) would be created for Ph.D. students engaged in dissertation research.

XI.B.3 Existing courses envisioned as a part of a new program and anticipated effects on enrollment

Our current graduate course offerings that support the M. S. degree program and the Materials Science program provide a solid starting point for building the curriculum to support the proposed Ph.D. program. Currently the department offers six 300-level courses: Mathematical Physics (PHYS 301), Teaching of College Physics (PHYS 305), Advanced Dynamics (PHYS 311), Electromagnetic Theory (PHYS 313), Quantum Mechanics II (PHYS 362), Solid State Physics (PHYS 341).

One of these courses is currently offered every semester so that over the two year period of the M.S. degree program students have the opportunity to take all four courses, although not all are required. *The reinstatement of the Ph.D. program in Physics will require that both the number of graduate courses regularly offered must be increased, and the frequency with which existing graduate courses are currently offered must also be increased.*

We expect small impact on the load of elective courses listed in the previous section due to Ph.D. students in Physics.

XI.B.4 Required New Courses

PHYS 365 - Statistical Mechanics (3 credits)
A new graduate course in Statistical Mechanics has been proposed to complete the Ph.D. core curriculum as compared to both peer and aspirant institutions. A course satisfying this description was taught in Spring 2016 by Prof. Del Maestro as Physics 323: Contemporary Issues in Physics – Phase Transitions and Critical Phenomena. The course proved very successful with 11 graduate student enrolled. Topics covered included:

- Statistical mechanics ensembles
- Phase space and Liouville's equation
- Phase transitions and critical phenomena
- Quantum statistics
- Renormalization group

The development of a permanent version of this course would include input from Prof. Del Maestro and Vanegas.

PHYS 356 - Computational Physics II (3 credits)
A new graduate course in Computational Physics will be created to further support the theoretical research of the department (in condensed matter and biological physics) and meet the growing demand for computational skills from Physics graduates. Although this course will be an elective for the Ph.D. program, we expect it will be well attended judging from the popularity (15-18 students enrolled every year it has been taught) of the existing Computational Physics course (PHYS 256, 296 in previous years). This course will be co-developed by Profs. Del Maestro and Vanegas. The following topics will be covered:

- Molecular Dynamics and Monte Carlo simulations
- High-performance computing, parallelization, and GPU computing

- *Ab initio* and Density Functional Theory methods
- Feynman path integrals
- Numerical computation in many body systems

PHYS 491 - Doctoral Dissertation Research (1-9 credits)
For Ph.D. students who have passed the comprehensive examination and are performing research towards there doctoral degree.

XI.C Research endeavor

All graduate students will have committees with advisors and/or co-advisors within the Physics Dept. It is intended that committees will comprise faculty with a mix of expertise (e.g. biophysics, experimental and theoretical condensed matter physics, or astronomy). This framework is especially important in cases where the work spans across the clear subfield boundaries, for example in cases of overlap between soft and hard condensed matter physics. There are substantial research expectations of graduate students in the new Physics Ph.D. program. Expected outcomes include publication of manuscripts, attendance at conferences, and participation in grant proposal writing.

XI.D Field work

N/A

XI.E Submit two sample programs or otherwise illustrate the selection of courses, course load, and research or service time distribution.

Physics Ph.D. students will be required to complete a minimum of seventy-five graduate credits including a minimum of twenty in dissertation research. This includes taking the required six core courses (PHYS 301 Mathematical Physics, PHYS 311 Advanced Dynamics, PHYS 313 Electromagnetic Theory, PHYS 323 Contemporary Physics, PHYS 362 Quantum Mechanics II, PHYS 365 Statistical Mechanics) and 4 elective courses in Physics or other related subjects. The core courses must be completed before the beginning of the third year in preparation for the comprehensive exam. Electives may be completed in any of the first three years, reserving the fourth year onward for progress towards the Ph.D. thesis. Students must have an overall grade point average in graduate courses of 3.25 or better. Students may take research credits during the first two years (PHYS 491) in preparation for a thesis proposal. After passing the qualifying examination at the end of the second year, students will enroll in PHYS 491 Dissertation credits for the remainder of their program.

Plan 1 - Biological Physics:

Year	Fall	Spring
1	PHYS 365 Statistical Mechanics (3) PHYS 301 Mathematical Physics (3) CHEM 301 General Biochemistry I (3)	PHYS 323 Contemporary Physics (3) PHYS 362 Quantum Mechanics II (3) CHEM 302 General Biochemistry II (3)
2	PHYS 313 Electromagnetic Theory (3) PHYS 222 Biological Physics (3) PHYS 491 Research (4)	PHYS 356 Computational Physics II (3) PHYS 311 Advanced Dynamics (3) PHYS 491 Research (4)
3+	PHYS 491 Dissertation (9)	PHYS 491 Dissertation (9)

Plan 2 - Condensed Matter Physics:

Year	Fall	Spring
1	PHYS 242 Intro to Solid State Physics (3) PHYS 301 Mathematical Physics (3) PHYS 365 Statistical Mechanics (3)	PHYS 323 Contemporary Physics (3) PHYS 362 Quantum Mechanics II (3) PHYS 491 Research (4)
2	PHYS 313 Electromagnetic Theory (3) PHYS 305 Teaching of College Physics (3) PHYS 256 Computational Physics (3)	PHYS 341 Solid State Physics (3) PHYS 311 Advanced Dynamics (3) PHYS 491 Research (4)
3+	PHYS 491 Dissertation (9)	PHYS 491 Dissertation (9)

XII Resources for the Program

XII.A Faculty

Note: Standard load in CAS for Physics faculty participating in the Ph.D. program is 40% Research, 40% Teaching and 20% Service. These commitments will not be affected by the new program.

XII.A.1 Participating Faculty Biographies

See Appendix.

XII.A.2 Effect on, and adjustments in, present staff assignments

We do not foresee any required modifications to the number of staff members in the department. However, additional burdens may be placed on our Departmental Administrator and Financial Manager in relation to dealing with an increased number of Physics graduate students in the department and a potential increase in active grants.

XII.A.3 New Positions to be Added

Prof. Valeri Kotov is currently the Chair of the Physics Graduate Studies committee. This Chair position would be altered to become the Director of the Physics Ph.D. program.

XII.A.4 Interdepartmental and inter-institutional cooperation planned.

Physics has a long history of collaboration with other departments in CAS (Chemistry, Geology) as well as across colleges with CEMS and COM. We expect that the proposed Ph.D. program will solidify current, and incubate new interdisciplinary collaborations on campus.

XII.B Library support:

XII.B.1 Present an evaluation of the library resources available currently to support the program;

The library resources currently available to the Department of Physics are suitable for the proposed program.

XII.B.2 Indicate additional demands to be made for this program with an estimate of the dollar cost of the additions.

The primary library demand to support the proposed Physics Ph.D. program are in access to relevant peer-reviewed journals, enabling faculty and students to maintain knowledge of state-of-the-art scientific advances. The current level of access to these sources through the UVM library system is deemed adequate to initiate the program and no significant changes are anticipated.

XII.C Equipment needs and plans to meet them.

There are two general categories of equipment needed to support the research efforts of the Physics Ph.D. program: shared equipment/facilities and equipment specific to a project. The needs for equipment specific to a project are determined by individual professors. Existing professors in the Physics Department already have sufficient project-specific equipment to conduct research, and can obtain more through externally funded grants. A successful track record of securing single-investigator, collaborative, and major research instrumentation grants has proven this model. Hiring of new TT faculty member is currently included in the CAS Five Year Strategic Plan. This new faculty member will require startup funds to populate their lab with project-specific equipment. These funds will come from the CAS budget. The approximate optimum ratio in a Physics Department is 2:1 experimentalists to theoreticians.

Needs for shared equipment and facilities will be largely met by existing equipment and additions within the new STEM Complex. The Department of Physics currently has a fully equipped machine shop and electronics shop, integral to nearly all experimental research and most of our teaching efforts for preparing demonstrations and active-learning infrastructure. Upon moving to the STEM Complex, the Physics Department gained access to a shared cleanroom, microscopy lab, two materials prep labs, and a wet chemistry lab. Each of these will be populated with existing equipment when possible. Basic microscopy facilities, including optical microscopes and an Atomic Force Microscope (AFM) will be available in the microscopy lab. The Department of Physics currently has an interdisciplinary proposal under evaluation at the NSF for the acquisition of a Scanning Electron Microscope (SEM) for the STEM Complex microscopy lab. The cleanroom will house existing semiconductor processing equipment for cleaning, etching, and photolithography. The materials prep and wet chemistry labs will enable basic synthesis of organic and inorganic materials, purification, and basic characterization. The STEM Complex is also equipped with the recovery plumbing for a helium recovery system.

XII.D Physical space needs and plans to meet them:

UVM is currently constructing a STEM complex consisting of a laboratory and a classroom/office wing. This STEM complex will house the Physics Department and contain adequate classroom, student study, laboratory, and office space. This space will include shared facilities such as a cleanroom, a microscopy lab, a theoretical physics meeting room, materials preparation labs, a wet chemistry lab, and laboratories for each of the experimental groups equipped with all modern research utilities. The timing of this proposal to reinstate the Ph.D. program in physics is ideally suited to maximize the impact of this new physical space. Our space needs will be entirely met by the new STEM complex and existing facilities on campus.

XII.D.1 Classroom and student study space

The new STEM Complex will bring 3,500 sq. feet of state-of-the-art active learning classrooms and teaching lab space.

XII.D.2 Laboratory and research space

The new STEM Complex will provide 9,000 sq. feet of research lab space and an additional 1,500 sq. feet of research support space including prep labs, microscopy facilities and the machine and electronics shop.

XII.D.3 Office space

Faculty office space consists of 2,700 sq. feet while graduate student and postdoc offices make up another 2,000 sq. feet. This space is deemed suitable to house the increased number of graduate students in the physics Ph.D. program.

XIII Cost estimates:

In 2005, a visiting committee was convened by CAS Dean Eleanor Miller to consider the costs and benefits of reinstating the Ph.D. program in physics at UVM. The committee consisted of Dr. Williiam Stwalley (Trustees Distinguished Professor of Physics at University of Connecticut), Dr. Martin Wybourne (Vice Provost for Research and the Francis and Mildred Sears Professor of Physics at Dartmouth College), and Dr. Kevin Bedell (Vice Provost for Research and Rourke Professor of Physics at Boston College). The committee was strongly supportive of the proposed physics Ph.D. program at UVM and provided a report detailing the additional resources required for its successful reestablishment.

On November 4-5, 2014, an external review panel consisting of Dr. James Labelle, Lois L. Rodgers Professor and Chair of the Department of Physics and Astronomy at Dartmouth College, and Dr. Michael J. Naughton, Ferris Professor and Chair of the Department of Physics at Boston College, visited the University of Vermont's Department of Physics as part of its Cycle 4 academic program review. The external review panel submitted a 9-page report in December 2014 that analyzes the quality of the department's academic programs and recommends directions for future development.

Despite the 9 year separation, there was broad agreement between the 2005 consultant's report and the 2014 external review report. Both committee reports strongly recommend the reestablishment of the Physics Ph.D. program, and after a rigorous assessment of the proposed program's curricular and research needs, both committees agreed that the ideal number of Physics faculty

required for supporting, sustaining and growing a nationally recognized Ph.D. program at UVM is in the range 12-14. These conclusions are also supported by studies of the American Institute of Physics (AIP) Statistical Research Center.

Currently the Physics Department consists of 10 tenure-track/tenured faculty lines, 3 full-time lecturers, and 5 permanent staff members - below the staffing level suggested by the external committees. However, as detailed in the attached letter of support from CAS Dean Bill Falls,"The College's five-year plan provides for a tenure track hire in Physics. The College is committed to this hire, maintaining the number of FTE faculty in the Department and growing graduate student GTA's as undergraduate enrollments grow." With this commitment in mind, we have devised a budget, teaching and advising plan which will allow us to initiate a start-up phase of the Physics Ph.D. program in a revenue-positive way with the main feature being the admission of new cohorts only in every-other-year (FY20, FY22 and FY24). As we look to the future and expect further growth we will settle into a conventional program cohort of approximately 5 students admitted per year.

The Physics Department currently supports eleven graduate students with Graduate Teaching Assistantships (GTAs). These graduate students are pursuing either a M.S. Physics degree (2) or a Ph.D. in the Materials Science Program (9). The remainder of Materials Science graduate students (5) working with faculty from the Physics Department are supported on Graduate Research Assistantships (GRAs) supported via extramural research grants. We ultimately envision a program with approximately twenty full-time Ph.D. students with roughly one third supported via extramural funding on GRAs.

No additional staff positions will be required to support the proposed Ph.D. program. We have recently hired in 2016 a new business manager at a higher job classification in anticipation of the additional financial activities (increased number of external research grants and budgetary transactions) associated with the proposed program.

XIII.A Total costs for first five years in addition to current budget

A projected budget during the start-up phase of the Physics Ph.D. program is included in Figure 2. The non-personell costs included at a level of $5,000 per year are associated with the advertisement of the program and recruitment of students. This includes: (1) announcements of the new program the program in professional journals such as *e.g.* Physics Today ($1000 per year); (2) travel costs for three campus visits ($3500 per year); and (3) expenses related to recruitment "Open Houses" ($500 per year).

At present, the Physics Department has 11 GTA positions which are distributed to both Physics M.S. and Materials Science Ph.D. students as detailed above. In order to support the start-up phase of the program, and ensure the continued success of the Materials Science Program, Graduate College Dean Cynthia Forehand has committed 2 additional GTAs bringing the total to 13. As these GTAs are supported by the Graduate College and intended for Materials Science students, they are not considered part of the Physics Ph.D. program budget. During the Physics Ph.D. program startup-phase, we plan to allocate approximately 8/13 GTA positions to incoming students matriculating in the Physics Ph.D. program. In order to stimulate research programs in all represented fields (theoretical or experimental) the graduate students advisees supported on a physics GTAs will be distributed as evenly as possible among the faculty and their respective disciplines. The remaining 5/13 GTAs will be offered each year to the Materials Science program. All GTA positions will continue to support the teaching needs of Physics at UVM regardless of the home program of the individual Ph.D. student.

These GTAs will be allocated to new students entering in staggered cohorts in FY20, FY22 and

Physics PhD Program Proposal Budget

	FY20	FY21	FY22	FY23	FY24	FY25	TOTAL
PhD Self-Funded Tuition	$21,744	$22,392	$46,116	$47,484	$51,778	$50,400	$239,914
PhD GRA Tuition	$0	$0	$0	$22,470	$7,257	$27,420	$57,147
Total Revenue	**$21,744**	**$22,392**	**$46,116**	**$69,954**	**$59,035**	**$77,820**	**$297,061**
Personnel Direct Expense							
Total Staff/Faculty Personnel	$0	$0	$0	$0	$0	$0	$0
Total GTA Stipends & Fringe	$0	$0	$0	$0	$0	$0	$0
Nonpersonnel Direct Expense	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$30,000
SubTotal Direct Expenses	**$5,000**	**$5,000**	**$5,000**	**$5,000**	**$5,000**	**$5,000**	**$30,000**
SubTotal Alg 7 a-f Expenses	**$10,387**	**$10,595**	**$20,648**	**$21,056**	**$34,713**	**$34,814**	**$132,213**
Total Expenses	**$15,387**	**$15,595**	**$25,648**	**$26,056**	**$39,713**	**$39,814**	**$162,213**
Net	**$6,357**	**$6,797**	**$20,468**	**$43,898**	**$19,322**	**$38,006**	**$134,848**

Figure 2: Projected budget detailing a new cohort of 4 students entering in FY20 and FY22 and a cohort of 5 in FY24 with 1 new self-paying student entering with each staggered cohort. GRA Tuition revenue fluctuates as students enter continuing registration status before graduation. More details are provided in the text.

FY24. Based on our experience with the Materials Science Ph.D. and Physics M.S. program we project that there is enough interest in the new program to recruit 1 self-paying student with each cohort as detailed in Figure 2 taking 18 credits at the blended graduate tuition rate. Additional revenue to CAS is projected through tuition for GRAs supported via extramural grants. This revenue is expected to first be realized in FY23 as 3 students from the first cohort are transferred from GTAs to GRAs reflected in 30 credits. There could be short-term fluctuations in this revenue as students move to continuing registration status before graduation as reflected in FY24.

There is no specific current CAS commitment outside the 5-year staffing plan for hiring additional faculty specifically for the Ph.D. Program, and thus no additional costs associated with faculty lines are listed in this budget. To meet our long-term goals of 12-14 faculty the Physics Department is actively seeking partners on campus to support the interdisciplinary hiring of faculty which could have appointments in multiple Departments or Colleges. One potential plan would be to hire as part of a proposed “Center for Biomolecular Sciences and Engineering" which is well-aligned with current strategic goals of the Office of the Provost. While such hires would allow us to more rapidly move out of the start-up phase of staggered cohorts they are not essential to the creation of the program at this time.

There exist additional opportunities for new revenue generation, not reflected in the above cost estimates. These include sources of support that will result from the overall vast improvement of the research and educational environments in the department. On the basis of our extensive

experience with federal grant applications and funding, we can state with great certainty that our ability to attract such funding (especially NSF, but DOE and others as well) at present is seriously compromised by the lack of Ph.D. students that can be dedicated to working on federal projects. Program officers and referees have often expressed concerns that we lack the overall institutional environment, in particular the physics graduate students, to engage in such projects. We completely understand those concerns, especially since we compete against other research universities, all of them having Ph.D. programs in physics. Program officers and referees judge us under the assumption that a Ph.D. Physics program is the norm, while we clearly stand out as a unique and unfortunate exception among the funding applicant pool of flagship state research universities. Consequently we expect the ability of our faculty to attract funding will increase dramatically, and with it F&A contributions as well. In addition, new faculty typically have a great record in attracting funding, especially when provided with the proper environment to succeed. When a steady cohort of graduate students is established, numerous additional funding opportunities will become available, such as graduate fellowships from the National Academy of Sciences, specific grants from NSF targeting graduate education support, educational grants targeting improvements in teaching infrastructure, etc. We are also committed to taking full advantage of the Bridge program, administered by the American Physical Society with the goal of supporting minority and underrepresented physics students, and the numerous corresponding funding opportunities available. The Physics Ph.D. program will also allow us to participate more actively and successfully in collaborative efforts (grants) both nationally, internationally, and of course within the STEM interdepartmental environment at UVM. Offering the Physics Ph.D. degree will make junior UVM Physics faculty eligible for prestigious research awards for which they currently cannot apply, for the sole reason that the department does not offer this degree. One such award is the Research Corporation Cottrell Scholar Award. Other UVM STEM faculty in departments that do offer a Ph.D. have been recipients of this award.

XIII.B Anticipated non-University support

The physics faculty has been very successful in recent years in securing federal funding to support the department's research programs. We attract external funding to the rate of $120,600 per tenured faculty member per year with 70% of the tenure-track faculty having extramural support. We will aggressively pursue extramural funding to support our research programs.

Alumni donors have also generously given to the department in support its research and teaching activities. Recent gifts include: $150,000 from Ms. Jeanne Detenbeck to establish an endowment for supporting graduate education in physics, and $500,000 bequest from Ms. Ellie Sikora to establish a fund to support undergraduate women engaged research in the physical sciences. We will continue to engage our alumni base in an effort to attract additional financial support of our programs.

XIII.C How program will be funded if no new money is available;

This program is consistent with working within the resources already allotted to the Department of Physics. These resources include the current faculty lines, GTA lines, and one additional faculty line promised in the CAS 5-Year Plan as detailed in CAS Dean Falls' letter of support.

XIII.D Proportion of salary of any faculty member who would contribute to program.

Faculty participating in the Ph.D. program in Physics will continue to receive a 9-month salary from the University while the remaining 3-months (constituting 25% of their 12-month effort) will

be expected to be covered from extramural funding sources.

XIV Schedule for Program

XIV.A Proposed starting date;

Fall 2019.

XIV.B When will curriculum or academic program be offered

Physics 3XX courses will be taught during the academic year while research will be performed year round.

XV Evaluation:

XV.A What criteria for evaluation will be applied?

The proposed Ph.D. program will be evaluated under UVM's academic program review process. Details of this process can be found at:

https://www.uvm.edu/provost/?Page=academicprogramreview.html.

Discipline specific learning outcomes and relevant evaluation metrics include:

a. Demonstrate mastery of the core physics disciplines.

   Student Evaluation: Passing core courses with a grade of B or better. Passing of the comprehensive exam.

   Departmental Evaluation: Maintain an average of 75% or greater of the Ph.D. students achieving this learning outcome.

b. Train successful and independent researchers.

   Student Evaluation: First and contributing authorship on peer-reviewed publications. Poster and oral presentations at scientific conferences and meetings.

   Departmental Evaluation: Aggregate totals of publications and presentations featuring UVM Physics Ph.D. students as authors, and the related citation bibliometrics will be used to measure the research output of our students.

c. Career preparation for diverse opportunities.

   Student Evaluation: N/A

   Departmental Evaluation: Track placement of students upon completion of the program, and throughout their careers through alumni surveys at 5-year intervals.

XV.B How and by whom will the program be evaluated?

The program will be evaluated nominally every eight years by the Associate Provost for Teaching and Learning as part of the academic program review for the Department of Physics.

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The University of Vermont
Richard A. Galbraith, MD, PhD
Vice President for Research

September 22, 2017

Jun-Ru Wu
Professor and Chair
Department of Physics
UNIVERSITY OF VERMONT
Discovery Hall W420B
Burlington, VT 05405

Dear Professor Wu:

I am writing to express my support for the reinstatement of a Ph.D. program in Physics at the University of Vermont. Physics is a core STEM discipline for which Ph.D. level research and education is a staple of research universities throughout the country and around the world. This program is critical to the success of UVM's role as a regional leader in STEM fields and the Provost's goal of doubling STEM enrollment on campus. I foresee great potential for this program to drive research growth at the University of Vermont.

Enhanced Physics research capabilities will strengthen current, and incubate new interdisciplinary endeavors on campus. It will allow the University to attract the best students, researchers, and faculty and increase research productivity with more opportunities for collaboration and external funding. With deep investment in STEM infrastructure on campus, it is an opportune time to initiate the reinstatement of the Ph.D. program.

Sincerely,

Richard A. Galbraith, MD, PhD

OFFICE OF THE VICE PRESIDENT FOR RESEARCH
330 Waterman Building, 85 South Prospect Street, Burlington, VT 05405
(802)656-2918 • Richard.Galbraith@uvm.edu

The University of Vermont

October 12, 2017

Jun-Ru Wu, PhD, Chair
Department of Physics

Dear Jun-Ru,

It is with great enthusiasm that I write in support of your efforts to reestablish the PhD in Physics. The Department clearly possesses the intellectual and research heft to support a vibrant and successful PhD program.

The College's five-year plan provides for a tenure track hire in Physics. The College is committed to this hire, maintaining the number of FTE faculty in the Department and growing graduate student GTA's as undergraduate enrollments grow.

Sincerely,

William A. Falls
Dean, College of Arts and Sciences

Cc: Randy Headrick, PhD
Valeri Kotov, PhD
Cynthia Forehand, PhD, Dean of the Graduate College

COLLEGE OF ARTS AND SCIENCES
OFFICE OF THE DEAN
Lattie F. Coor House, 438 College Street, Burlington, VT 05405
(802) 656-3344 Student Services
(802) 656-3166 Faculty and Administrative Services

The University of Vermont
LARNER COLLEGE OF MEDICINE

FREDERICK C. MORIN III, M.D.
DEAN

November 16, 2017

Junru Wu, Chair
Department of Physics
University of Vermont
Burlington, VT 05405

Dear Professor Wu,

As Dean of the Larner College of Medicine (LCOM), I endorse the proposed PhD program in physics. Academically, the proposed PhD program could greatly benefit graduate students in LCOM and other colleges and schools at UVM.

I have discussed with Dean Falls the possibility of working with the Department of Physics to further develop expertise in biological physics on campus. This is fertile ground for collaboration with LCOM. We hope to explore a new joint tenure-track position between CAS and LCOM that would participate in the proposed degree program in physics.

You have the enthusiastic support of LCOM for the proposed PhD program in physics.

Sincerely,

Frederick C. Morin, III, MD
Dean

do/do/graduate education/college of arts & sciences/physics phd program junru wu los 16nov17

THE ROBERT LARNER, M.D. COLLEGE OF MEDICINE AT THE UNIVERSITY OF VERMONT
OFFICE OF THE DEAN | E-126 GIVEN BUILDING | 89 BEAUMONT AVENUE | BURLINGTON, VT 05405-0068
PHONE 802-656-2156 | FAX 802-656-8577 | RICK.MORIN@UVM.EDU | WWW.MED.UVM.EDU

The University of Vermont

November 6, 2017

Dear Junru Wu,

I am writing to provide feedback for the proposal for a PhD program in Physics at the University of Vermont.

I want to be supportive of the ambitions of my colleagues in Physics for a PhD program, however I cannot justify offering my support to a proposal that is not reflective of our current financial realities.

Physics is currently staffed by 10 tenure-track faculty, 3 lecturers and 5 support staff. From my perspective, and that of the full CEMS leadership group, we feel that Physics has a significant and sufficient investment already to fully support a PhD program. We all need to evaluate every commitment to ensure that it is strategic and supportive of the college's vision and that it can be sustained. I do not feel that your proposal meets this last criteria. I urge you to re-evaluate the request for new resources outlined in the proposal because I believe it will jeopardize the most important goal which is creating the degree program.

It is possible that I misunderstand the proposal. It appears to show a cost of $700K+ in the first four years (not including the start-up for the new faculty member). Additionally it calls for an increase in the number of GTAs from the current 11 to 19 (this would be an additional 5 GTAs beyond the 2 shown in the proposal budget).

In summary, while CEMS appreciates the interest in Physics in creating a PhD program, we cannot support the proposal in its' current form.

Sincerely,

Luis Garcia, Ph.D.
Dean, College of Engineering and Mathematical Sciences

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Valeri N. Kotov, Associate Professor
Physics Graduate Director

University of Vermont
Department of Physics
Discovery W416, 82 University Place
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E-mail: valeri.kotov@uvm.edu

Burlington, November 28, 2017

To: **Nicole Phelps**, CAS Curriculum Committee Chair
Re: Clarification regarding letter from CEMS Dean Garcia and related matters

Dear Nicole,

The purpose of this letter is to provide some explanations and context to the feedback we received from CEMS Dean Garcia regarding the Physics PhD Proposal (letter attached to the proposal). We asked him to write us a letter of support, and I know that previously he also had discussions about the proposal with CAS Dean Bill Falls and Associate Dean Rory Waterman. Below I would like to describe the Physics Department's, and in particular my experience in the matter.

Dean Garcia expresses reservations about faculty and GTA resources needed for the Physics PhD program. After we received his letter we made several attempts to clarify things with him as we feel that he misunderstands some details in our proposal. We have provided detailed explanations by email (on two occasions) and in addition have made substantial revisions to the proposal (especially in the "cost" analysis part) in order to make the resources section clearer. I kindly asked Dean Garcia to re-evaluate his position hoping that he would revise his letter to reflect support for the proposal, but received no reply from him. Since we took his feedback and concerns seriously and made substantial changes to the text and content of the proposal I was puzzled why he chose to ignore us. I would be happy to provide, if needed, my e-mails (as well as the latest version of the proposal) that I sent him. Specifically I would like to point out the following in rebuttal to Dean Garcia's letter:

- We do not have any additional GTA resources written in the proposal (Dean Garcia erroneously quotes an increase up to 19 GTAs).
- There is only one "additional" physics faculty hire, which is included in the CAS five year strategic plan (and already approved by the CAS Dean). The CAS planning was launched last year, before our proposal took shape. Dean Garcia has been unresponsive when I attempted to clarify this (and the previous) point.
- We prepared the proposal in exhaustive collaboration with CAS Dean Falls who has instructed us to make the proposal consistent with available resources. In the meantime, with the help of the CAS leadership, other colleges, and the office of the Provost, we are exploring possibilities for joint hires and other avenues to increase our faculty numbers towards a level that we consider optimal, long-term, for a PhD program in physics. These efforts are ongoing (see letter of support from College of Medicine Dean Morin) but we are willing to launch the program as soon as possible.

- As a general matter, it is not clear why Dean Garcia focuses on this particular point, namely the number of faculty and graduate students needed for a PhD program. His previous experience as a department head and Dean of an Engineering college does not necessarily lead to a correct evaluation of resources needed for Physics. We think that we are more competent to judge what our needs are, based on extensive consultations with other physics departments across the country (of similar size) and our overall experience. All this is presented in the proposal. In particular he provides no substantive evidence to back up his claim that "Physics has a significant and sufficient investment already to fully support a PhD program."

- Finally let me point out that there is a long history of collaboration (in research, grants, etc.) between faculty in our department and CEMS faculty. In addition, a Physics PhD program supporting the transition to Active Learning classrooms would be a very positive development towards retention of engineers enrolled in introductory physics courses. This is supported by substantial Physics Education Research as cited in the proposal. I was hoping that these positive effects that benefit both our colleges would be far more important to Dean Garcia.

To conclude, I hope you consider Dean Garcia's letter in the context of my remarks outlined above. While I of course welcome constructive criticism, quite frankly I am very disappointed and troubled by the tone of non-cooperation that Dean Garcia has set which, indirectly, also affects our very good relationships with many CEMS departments (who I know from personal interactions look positively at a Physics PhD program.) At a time when UVM is expanding STEM facilities, our priority should be cooperation for the benefit of all STEM disciplines. Given that Dean Garcia is stepping down at the end of this academic year, we will be extending our hand in friendship and cooperation to the new CEMS leadership.

Thank you very much for your consideration. I hope you attach, in some form, my letter to the proposal as it goes through the UVM approval channels.

Yours Sincerely,

Valeri Kotov

The UNIVERSITY of VERMONT
RUBENSTEIN SCHOOL
OF ENVIRONMENT AND NATURAL RESOURCES
DEAN'S OFFICE

November 6, 2017

Dr. Junru Wu, Ph.D.
Chair and Professor of Physics
The University of Vermont
Department of Physics
STEM Discovery Hall, Room W420B
Burlington, VT 05405

Dear Dr. Wu:

The proposed Ph.D. program in Physics at the University of Vermont has my full support as Dean of the Rubenstein School of Environment and Natural Resources at UVM. It is crucial that UVM offer the global standard terminal degree in Physics if we are to be considered a regional leader in STEM fields. The recent investment in STEM infrastructure, combined with the expertise and vision of the Physics faculty, create a prime environment for the successful implementation of such a program.

The proposed Physics Ph.D. program will benefit the faculty and students of the Rubenstein School in several ways. The increased research and education efforts in Materials Science, Biophysics, and Condensed Matter Physics will provide many more opportunities for collaborative work. Courses such as PHYS 009 Energy & the Environment, which are of great interest to our students, may be offered more frequently and/or co-taught by Physics and Rubenstein instructors. And UVM's reputation as an environmental leader will surely be strengthened by the increased solar energy research efforts of professor Headrick, Furis, and White in UVM Physics.

Sincerely,

NANCY E. MATHEWS
Dean and Professor

The UNIVERSITY of VERMONT

Department of Physics
Discovery Hall
82 University Place
Burlington, Vermont 05405-0125
Tel: 802-656-5177
Fax: 802-656-0817

To: **Prof. Jun-ru Wu**
Physics Department Chair

Dear Jun-ru,

I am writing to convey my unmitigated support for reinstating the Physics PhD program at the University of Vermont. Strong Physics research and graduate education sit at the foundation of all successful STEM programs across the country. The research accomplishments of Physics PhD students and their advisers are instrumental in solving some of the grand challenges facing society today from sustainable energy to understanding biosystems at the molecular level.

As director of UVM's Materials Science (MATS) program, I am fully aware that solving these grand challenges demands strong traditional science and engineering programs coming together to create a nexus for thriving interdisciplinary research.

The UVM physics department specific plans for a PhD program will have a positive impact on the existing MATS program. For example, it will bring top notch researchers with complementary expertise, forming a critical mass for successful and credible large-scale research efforts that would bring UVM STEM education national recognition in areas such as sustainable electronic and bio-inspired materials.

Our program will also benefit from the larger pool of course offerings at the graduate level. The enhanced number of tenure-track physics faculty will enable a more competitive and diverse MATS curriculum, a MATS minor that is extremely attractive to science and engineering majors, and a possible MATS major in the longer term.

The most successful undergraduate students in STEM are the ones who gain research experiences alongside PhD students, postdocs and tenure-track faculty research – active advisers. The physics PhD program is the only missing ingredient in such a successful STEM recipe for attracting high quality undergraduate students towards a true interdisciplinary research experience.

The plan to dedicate a minimum of three physics teaching assistantships to MATS students will ensure that both programs will thrive together in the future, maintain their competitiveness on the federal funding scene, and increase their ability to attract high quality graduate students.

In conclusion, the existence of a PhD program in Physics will help the Materials Science and the UVM STEM program rise from a collection of exceptional single-investigator individual accomplishments to a robust, well-rounded, center of excellence in interdisciplinary research and education with national recognition.

I wish you all the best in rebuilding the PhD program in Physics.

Yours Sincerely,

Madalina Furis
Materials Science Program Director

September 2017

The University of Vermont
Department of Physics
W420B, Discovery Hall
Burlington, Vermont 05405-0125
Tel: 802-656-8357
Fax: 802-656-0817

November 27, 2017

To: Dean of the College of Arts and Sciences

Re: Support to Reestablishment of Ph. D Program in Physics

Dear Bill,

I would like to express my strong and enthusiastic support for the proposed Physics PhD program. As the proposal outlines, the physics faculty is recognized both nationally and internationally for their unique blend of research expertise in the areas of condensed matter physics, biological physics, and astrophysics. The proposed program will contribute substantially towards this goal. Given the existing strengths of the small but outstanding physics department at UVM, a very modest investment in this program will achieve numerous opportunities for improved education, research, collaboration and fusion of basic science and technology at UVM and across the state of Vermont.

The proposed program will: (1) significantly improve the research environment within the mentioned physics subfields, consequently expanding the opportunities for collaboration across all STEM fields, (2) significantly improve the quality of undergraduate education and research in physics and all STEM disciplines. It is universally accepted in the science and technical fields that university's ability to attract, retain, and successfully train undergraduate students is strongly dependent on the existence of a vibrant graduate program. Given the steady rise of the STEM undergraduate student population at UVM, we should provide them the best possible education and future employment opportunities in our unique small premiere research university environment.

As a chair of the department, I certainly will do my best to make it a reality in the near future.

Sincerely and with my best wishes

Professor Junru Wu
Chair, Physics Department
University of Vermont

The University of Vermont

PROF. CHRISTOPHER LANDRY
Department of Chemistry, Cook Physical Sciences Building
82 University Place, Burlington, VT 05405
(802) 656-0270 • fax: (802) 656-8705
christopher.landry@uvm.edu • www.uvm.edu/~chem

September 13, 2017

Prof. Dennis Clougherty
Department of Physics
University of Vermont
Burlington, VT 05405

Dear Dennis,

I write in support of the Physics Department's proposal to reinstate the Physics Ph.D. program. In my opinion, the Physics Department has done an outstanding job of hiring the types of successful teacher-scholars necessary for a Ph.D. program, and the track record of the faculty in Physics gives a good indication of its potential success. An expanded pool of Physics graduate students will support research efforts of the faculty. I find the Department's plan to focus on condensed matter physics and biological physics especially compelling, as those are areas that will complement the focus areas of other departments in the Northeast and will play to the existing strengths of the Physics Department and the University.

It is critical to have high quality graduate research programs in the basic sciences at UVM, and the Physics Department's proposal is an important component in maintaining the scholarly profile of the College of Arts & Sciences. I concur with the statements in the proposal that the Physics and Chemistry Departments have a long history of collaboration, and I look forward to the successful implementation of the Ph.D. degree in Physics.

Best of luck with the proposal.

Sincerely,

Christopher Landry
Professor and Chair, Department of Chemistry
University of Vermont

The UNIVERSITY of VERMONT

Department of Biology, Marsh Life Sciences Bldg., Burlington, VT 05405
Phone: (802) 656 2962, Fax: (802) 656-2914, email: scahan@uvm.edu

November 15, 2017

Prof. Jun-Ru Wu,
Chair, Department of Physics

Dear Dr. Wu,

I am writing as the Chair of the department of Biology in support of your proposed PhD program in Physics. As a STEM department within the College of Arts and Sciences that has a PhD program in place, I know first-hand the value of having a PhD program for every aspect of your research and teaching missions. Graduate students facilitate and enhance faculty research activity and productivity, and the broader impacts of training PhD students for STEM careers is particularly valuable for securing extramural grant funding from federal agencies such as NSF. Given the teaching and research demands placed on faculty in our own department, which I imagine would mirror yours, I can say with near certainty that if we were to discontinue our PhD program, a majority of our faculty would seek employment elsewhere so as not to jeopardize their research programs. Its existence also translates into a stronger, more research-focused applicant pool for tenure-track faculty positions, as it communicates the value placed on research at our institution.

Graduate students also participate in instruction, particularly for core laboratory courses, which would allow you to more efficiently increase capacity for the many constituencies requiring physics for their major or pre-health track. Having this capacity will undoubtedly be important for launching new undergraduate initiatives such as a Biophysics major or Material Science minor. This may also free up faculty time to offer more specialized advanced offerings that are otherwise forced onto the back burner by enrollment management trade-offs. Perhaps more importantly, they serve as mentors for students in the laboratory, providing more opportunities for students to get involved in research and more of a community-building experience for them as part of a research group. My own graduate students have typically mentored 2-3 undergraduates each per year, which is in addition to the few that I have the time to mentor directly.

I recognize that there are costs to having a PhD program that is not specifically designed to be revenue-enhancing, but these costs are balanced if not outweighed by the benefits for scholarly productivity, F&A return, and undergraduate recruitment and retention. I fully support your proposed program and hope that your proposal is seriously considered.

Sincerely,

Sara Helms Cahan
Associate Professor and Chair, Department of Biology

The University of Vermont

Yves Dubief, PhD

Department of Mechanical Engineering
33 Colchester Ave
Burlington VT 05405

Interim Chair
Associate Professor
Phone: (802) 656-1930
E-mail: ydubief@uvm.edu

November 29, 2017

RE: Support for the creation of a PhD program in Physics

Dear Prof. Wu,

I am writing this letter in support of your proposal for the PhD program. The Department of Mechanical Engineering and the Department of Physics have had a longstanding productive research partnerships through the Material Science program. Our students have frequently benefited from upper level graduate Physics courses.

A PhD program of physics will likely help strengthen our own PhD program with respect to graduate courses and collaborative research. As an example, Prof. Fletcher taught an ME 395 on optical diagnostics to both ME and Physics students. This course would not have met the minimum enrollment requirement with students for only one of these departments. There have been multiple collaborative research awards between ME and Physics Faculty, the continuation of this joint effort will likely a great support for the Physics PhD program.

Overall, the proposal is sound and the current Faculty has, I believe, the ability to offer and sustain a PhD program.

Sincerely,

Yves Dubief

The University of Vermont

ROBERT LARNER COLLEGE OF MEDICINE
DEPARTMENT OF MOLECULAR PHYSIOLOGY & BIOPHYSICS
HEALTH SCIENCE RESEARCH FACILITY, 149 BEAUMONT AVENUE
BURLINGTON, VERMONT 05405-0075 U.S.A.

TELEPHONE: (802) 656-2540
FAX: (802) 656-0747
Email: david.warshaw@med.uvm.edu

August 22, 2017

Dr. Junru Wu
Department of Physics
University of Vermont

Dear Junru,

I am writing to express my full support for the PhD program in Physics at the University of Vermont. Physics is a core STEM discipline for which PhD level research and education is a staple of all research universities throughout the country and around the world. This program is critical to the success of UVM's role as a regional leader in STEM fields.

As the chair of the Department of Molecular Physiology & Biophysics, I can speak to the significant ways the proposed Physics PhD program will benefit my department. The increased research efforts in Biophysics and Condensed Matter Physics will provide many more opportunities for collaborative work with faculty in the Larner College of Medicine. The Physics Department will teach more graduate level courses in biophysics and computational physics, which could benefit our students. The PhD program will also enable an undergraduate major in Biophysics, which could provide excellent students for our graduate program, as well as joint research and teaching opportunities.

Sincerely,

David M. Warshaw, Ph.D.
Professor and Chair

VERMONT ADVANCED COMPUTING CORE
210 Colchester Avenue, Farrell Hal
Burlington, Vermont, 05405l
802-656-8867 • fax: 802-656-5838
vacc@uvm.edu • www.uvm.edu/vacc

Aug 22, 2017

Dear Dean Falls;

I am writing in my capacity as the Interim Director of the Vermont Advanced Computing Core, UVM's high performance computing cluster, to express my full support for the proposed PhD program in Physics. The University of Vermont's ability to attract the best researchers, teachers and students and our continued leadership and development in cutting edge science and technology hinges upon having strong foundational STEM programs. Computational Physics has emerged as a field which connects not only experimental and theoretical physics but also drives interdisciplinary research in the diverse field of Materials Science. I foresee a continued use by physics faculty and their graduate student of the computational services we provide at the VACC. If you have any further questions, please don't hesitate to contact me.

Sincerely,

Adrian Del Maestro
Associate Professor of Physics
Interim Director, Vermont Advanced Computing Core
University of Vermont
802-656-0068
adrian.DelMaestro@uvm.edu
http://www.delmaestro.org/adrian

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Kate P. Kirby
Chief Executive Officer

Phone: (301) 209-3270
Fax: (301) 209-0865
Email: kirby@aps.org

September 1, 2017

Dr. William Falls
Dean, College of Arts and Sciences
University of Vermont
Burlington, VT 05405

Re: Proposed physics Ph.D. degree program at the University of Vermont

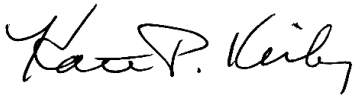
Dear Dean Falls,

I am writing to you to express my strong support for the proposed physics Ph.D. program at the University of Vermont. The physics Ph.D. curriculum is at the core of STEM graduate education. Having a robust physics Ph.D. program will positively impact all graduate programs in science, engineering and mathematics at UVM by providing foundational graduate courses and deepening institutional research expertise. A strong physics Ph.D. program will also contribute to the state's economy by attracting and training future generations of the high-tech workforce.

With the construction of your new STEM facilities and the recruitment of a high-quality, research-active physics faculty at UVM, now is an opportune time to launch a physics Ph.D. program. In fact, I would argue that having a physics Ph.D. program is essential in attracting top-flight research faculty to the UVM physics department. Experience shows that a Ph.D. program does not detract from the undergraduate program; rather, it enhances the undergraduate program by providing (1) a richer array of research opportunities for undergrads; (2) advanced courses that are available to upper-class students who intend to pursue graduate studies in science; and (3) an exposure to graduate students who frequently serve as mentors and role models for undergraduates.

For these reasons, there is currently a physics Ph.D. program in every state in the US, with the notable exception of Vermont. The establishment of a Ph.D. physics program at UVM will remedy this and help propel Vermont towards a position of STEM leadership in the Northeast.

Sincerely,



Kate P. Kirby, Ph.D
CEO, American Physical Society

DENNIS P. CLOUGHERTY

Department of Physics
82 University Place
University of Vermont
Burlington, VT 05405–0125

Telephone: (802) 656–0063
Fax: (802) 656–0817
Email: Dennis.Clougherty@uvm.edu
URL: www.uvm.edu/physics/dpc

EDUCATION

Massachusetts Institute of Technology

Ph. D. – Physics, June 1989
Thesis advisers: Professors D. Adler and K. Johnson
B. S. & M. S. – Electrical Engineering and B. S. – Physics, June 1982
Thesis adviser: Professor H. Haus

PROFESSIONAL EXPERIENCE

University of Vermont, Department of Physics & Materials Science Program
Chair (2008–2016), Professor (2003–present), Associate Professor (1996–2003), Assistant Professor (1992–1996)

University of California, San Diego, Dept. of Mechanics and Engineering Sciences
Lecturer (1992).

University of California, Santa Barbara, Department of Physics
Postdoctoral Fellow (1989–1992) with Professor Walter Kohn.

Massachusetts Institute of Technology, Department of Physics
Research Assistant (1984–89).

Steinbrecher Corporation, Millimeter Wave Group, Woburn, MA
Senior Engineer (1982–84).

TEACHING EXPERIENCE

University of Vermont, Department of Physics
Undergraduate courses: Mechanics (Physics 31); Electricity & Magnetism (Physics 42); Relativity (Physics 095); Waves and Quanta (Physics 128); Electromagnetism (Physics 213); Solid State Physics (Physics 242); Statistical and Thermal Physics (Physics 265); Quantum Mechanics I (Physics 273); Applications of Quantum Mechanics (Physics 274)
Graduate courses: Mathematical Physics (Physics 301); Advanced Dynamics (Physics 311); Electromagnetic Theory (Physics 313); Solid State Physics (Physics 341); Quantum Mechanics II (Physics 362); Relativistic Quantum Mechanics (Physics 323B).

University of California, San Diego, Materials Science Program
Lecturer (1992). Graduate course: Solid state chemistry (MS 227).

University of California, Santa Barbara, Department of Physics
(1990). Graduate course: Condensed matter physics (Physics 223B).

Massachusetts Institute of Technology, Department of Physics
Recitation Instructor (1988–89). Undergraduate courses: Mechanics (8.01); Electricity and Magnetism (8.02).

HONORS & AWARDS

University Scholar, University of Vermont (2014).

Faculty Research Fellow, Air Force Office of Sponsored Research (1995).

Senior Member, Institute of Electrical and Electronics Engineers (1994).

Who's Who in America

American Men and Women of Science

Sigma Xi, scientific honor society

Eta Kappa Nu, electrical engineering honor society

Sigma Pi Sigma, physics honor society

VISITING APPOINTMENTS

Visiting Scholar, University of Texas, Austin (2007).

Visiting Scientist, Harvard University (1999, 2006).

Visiting Associate Professor, University of California, Santa Barbara (1998, 1999, 2001).

Visiting Scientist, Kavli Institute for Theoretical Physics, University of California, Santa Barbara (1997).

Visiting Scientist, MIT, Department of Physics (1996–7).

Visiting Scholar, University of California, San Diego (1994)

Visiting Scientist, Los Alamos National Laboratory, Materials Science and Technology Division (1989).

GRANTS & PROPOSALS

Grant from NASA (2017-2020) ($750,000) for theoretical studies of cold atom interactions with strained graphene (co-I.: D.P. Clougherty, pending).

Grant from NSF (2011-2015) ($286,000) for an REU site on complex materials (P.I.: D.P. Clougherty; DMR-1062966).

Grant from ONR (2010-2013) ($330,000) for the theoretical study of the mechanical and thermal properties of metallic glasses (P.I.: M. Eberhart, co-PI: D.P. Clougherty; N00014-10-1-0838).

Grant from NSF (2008-2012) ($240,000) for the study of many-body effects in particle-surface scattering (P.I.: D.P. Clougherty; DMR-0814377).

Grant from DARPA (2006-2007) ($167,000) for the study of theoretical models of metallic glasses (P.I.: M. Eberhart, co-I: D.P. Clougherty).

Grant from VT EPSCoR (2004) ($20,000) was awarded for a high performance computational cluster (P.I.s: K. Chu, D.P. Clougherty, R. Headrick, J. Rankin)

Grant from DARPA (2001-2005) ($450,000) for the study of structure-property relationships in intermetallic design (P.I.: M. Eberhart; co-I: D.P. Clougherty; #MDA9720110041).

Grant from Smithsonian Institution (1999-2000) ($15,000) was awarded to investigate ferroelectricity in fulleride systems (P.I.: D.P. Clougherty).

Grant from University Committee on Research and Scholarship ($4,500) (1998) was awarded to perform electronic structure calculations on strongly correlated clusters and molecules.

Grant from American Chemical Society–Petroleum Research Fund (1994-1997) ($30,000) was awarded to investigate ultra-low energy physisorption of atoms onto surfaces at finite temperature (P.I.: D.P. Clougherty).

Grant from University Committee on Research and Scholarship ($4,600) (1993) was awarded to study the scaling behavior of threshold sticking on low energy atoms on surfaces.

Grant from Akzo Chemical ($40,000) (1991-1993) was awarded to investigate relations between electronic structure and mechanical properties of polymers.

Grant of eighty hours of computer time on the Cray YMP from the San Diego Supercomputer Center (1991) was awarded for the study of the electronic structure of magnetic multilayers.

Grant of forty hours of computer time on the Cray YMP from the San Diego Supercomputer Center (1990) was awarded to study the effects of electron correlation on ferromagnetism.

Grant from Los Alamos National Laboratory, Theoretical Division, Institutional Collaborative Program ($8,400) (1989) was awarded for the investigation of the electronic structure of magnetic systems.

THESES SUPERVISED

Ms. Sanghita Sengupta, "Diagrammatic Approach to Quantum Sticking," Ph.D. thesis, Materials Science (2017).

Mr. Adam Doherty, "Quantum Sticking of Cold Atomic Hydrogen to Graphene," B.S. Honors thesis, Physics (2013).

Dr. Yanting Zhang, "Orthogonality Catastrophe in Quantum Sticking," Ph.D. thesis, Materials Science (2012).

Mr. Ian Goyette, "Breaking Quantum Mirrors with Thermal Fluctuations," M.S. thesis, Physics (2011).

Mr. Charles Foell, "Theory of Vector Polarons," M.S. thesis, Physics (2006).

Mr. John Gergely, "Phonons and Thermal Transport in Carbon Nanotubes," B.A. Honors thesis, Physics (2002).

Mr. Xiang Zhu, "Thomas-Fermi Theory of Fullerenes," M.S. thesis, Physics (1996).

Mr. John Gorman, "A Theoretical Study of the Vibrations of C_{60}," B.S. Honors thesis, Physics (1995).

OTHER PROFESSIONAL EXPERIENCE

Served as consultant to various institutions, including Akzo Research, Inc. (1991-3), Los Alamos National Laboratory, Materials Science and Technology division (1987-90), Massachusetts General Hospital, Department of Neurology (1985-89), Optex Corporation, Rockville MD (1995-6), and Quantum Energy Technologies, Inc., Cambridge, MA (1997–2001), TecPlot Inc. Bellevue, WA (2007–11) and Taylor Associates, Winooski, VT (2008–11). Scientific adviser to Bloomberg & O'Hara, Burlington VT (1996-8), Cheney, Brock & Saudek, P.C., Montpelier VT (2006), "Absolute Zero and the Conquest of Cold" American Physical Society national educational campaign (2007-8).

Serve as ad-hoc referee for many scientific publications, including Physical Review A & B, Physical Review Letters, Carbon, Physica C, the International Journal of Quantum Chemistry, the Journal of Materials Science, the Journal of Magnetism and Magnetic Materials, Journal of Physics and Chemistry of Solids, Nature, Physica Status Solidi B, Journal of Physical Chemistry A & B and the Journal of Chemical Physics.

Serve as ad-hoc referee for funding agencies, including NSF, Petroleum Research Fund (ACS), the Research Foundation, the Department of Energy and the U.S. Civilian Research and Development Foundation.

Serve as a reviewer for a variety of publishing companies, including Wiley, Addison-Wesley, W.H. Freeman and Canopus Publishing (UK).

SELECTED COMMITTEES

University/College

Search Committee for Director of Institutional Research, appointed by Provost (2016)
Selection Committee for Williams Professor of Mathematics, appointed by Dean (2016)
Faculty Grievance Panel, appointed by Provost (2016)
Search Committee for Interim Dean, College of Arts & Sciences (2015)
Chair Search Committee, Department of Geology (2009–10)
Member, Transdisciplinary Research Initiative Working Group on Environment, appointed by Provost (2009–2010)

Chair, Review Panel on research misconduct, appointed by Dean of the College of Arts & Science (2008–9)
Faculty Standards Committee, elected by faculty of the College of Arts & Science (2007–2008)
Chair, Grievance Panel for Reappointment, Promotion & Tenure, appointed by Provost (2005)
Chair, Committee for the Pomeroy Professor of Chemistry, appointed by Dean of College of Arts & Science (2003)
Materials Science Steering Committee, (1994, 1998–2003)
Chair, Graduate Studies, Department of Physics (1993–98)
Executive Committee, Department of Physics (1993–96)
College of Engineering Curriculum Committee (1993–95, 2007)
Chair, Colloquium Committee, Department of Physics (1992–97)

External

National Science Foundation, Panel (2007, 2012, 2013)
Science Advisory Committee, ECHO Science Center, Burlington VT (2010-)
Visiting Committee, Colorado School of Mines, Materials Science Program (2008-10)
Scientific advisory board, 5th International Conference on Materials Science & Engineering, Guelma, Algeria (2008)
Organizing Committee, International Workshop on Quantum Reflection, ITAMP, Harvard University (2007)
Scientific advisory board, 3rd International Conference on Density Functional Theory of Metals and Alloys, Oran, Algeria (2007)
Visiting Committee, Massachusetts Institute of Technology, Department of Physics (1988)

PUBLICATIONS

D. P. Clougherty and S. Sengupta, "Infrared Problem in Quantum Acoustodynamics," under review *Phys. Rev. Lett.* (2017). [arXiv:1611.09445]

S. Sengupta, V. Kotov and D. P. Clougherty, "Infrared Dynamics of Cold Atoms on Hot Graphene Membranes," *Phys. Rev. B* **93**, 235437 (2016). [arXiv:1603.03476]

D. P. Clougherty, "Quantum Sticking of Atoms on Membranes," *Phys. Rev. B* **90**, 245412 (2014). [arXiv:1312.5754]

D. P. Clougherty, "Comment on 'Sticking of Hydrogen on Supported and Suspended Graphene at Low Temperature,' " *Phys. Rev. Lett.* **113**, 069601 (2014). [arXiv:1207.4019]

D. P. Clougherty and X. Zhu, "Stability and Teller's theorem: Fullerenes in the March model," *Phys. Rev. A* **89**, 029902(E) (2014).

D. P. Clougherty and Y. Zhang, "Orthogonality Catastrophe in Quantum Sticking," *Phys. Rev. Lett.* **109**, 120401 (2012). [arXiv:1112.4544]

Yanting Zhang and D. P. Clougherty, "Dissipative Effects on Quantum Sticking," *Phys. Rev. Lett.* **108**, 173202 (2012). [arXiv:1012.4405]

T. E. Jones, M. E. Eberhart and D. P. Clougherty, "Topological Catastrophe and Isostructural Phase Transition in Calcium," *Phys. Rev. Lett.* **105**, 265702 (2010). [arXiv:1012.0803]

Di Xiao, Junren Shi, D. P. Clougherty and Qian Niu, "Polarization and Adiabatic Pumping in Inhomogeneous Crystals," *Phys. Rev. Lett.* **102**, 087602 (2009). [arXiv:0711.1855].

T. E. Jones, M. E. Eberhart, D. P. Clougherty and C. Woodward, "Electronic Selection Rules Controlling Dislocation Glide in bcc Metals," *Phys. Rev. Lett.* **101**, 085505 (2008).

T. E. Jones, M. E. Eberhart and D. P. Clougherty, "Topology of the Spin-polarized Charge Density in bcc and fcc Iron," *Phys. Rev. Lett.* **100**, 017208 (2008).

D. P. Clougherty, "Polarons and Solitons in Jahn-Teller Systems," (invited paper) *J. Mol. Struct.* **838**, 203 (2007).

D. P. Clougherty, "Jahn-Teller Solitons, Structural Phase Transitions, and Phase Separation," *Phys. Rev. Lett.* **96**, 045703 (2006).

C.D. Havey, M.E. Eberhart, T. Jones, K.J. Voorhees, J. Laramee, R.B. Cody and D. P. Clougherty, "Theory and Applications of Dissociative Electron Capture in Molecular Identification," *J. Phys. Chem. A* **110**, 4413 (2006).

D. P. Clougherty and C. A. Foell, "Vector Polarons in a Degenerate Electron System," *Phys. Rev. B* **70**, 052301 (2004).

M.E. Eberhart and D.P. Clougherty, "Looking for Design in Materials Design," *Nature Materials* **3** 659 (2004).

D. P. Clougherty, "Anomalous Threshold Laws in Quantum Sticking," *Phys. Rev. Lett.* 91, 226105 (2003).

D. P. Clougherty, "Quantum Reflections," in **Walter Kohn**, M. Scheffler and P. Weinberger, Eds. (Springer Verlag, Berlin, 2003).

D. P. Clougherty, "Endohedral Impurities in Carbon Nanotubes," *Phys. Rev. Lett.* **90**, 035507 (2003).

D. P. Clougherty, "Ferroelectric Phase Transitions in a Lattice Pseudo-Jahn-Teller Model," in **Vibronic Interactions in Crystals and Molecules**, M. Kaplan and G. Zimmerman, Eds. (Plenum, New York, 2001).

D. P. Clougherty, "Ferroelectricity in $(K@C_{60})_n$," in **Fundamental Physics of Ferroelectrics**, Ronald Cohen, Editor (AIP, New York, 2000).

D. P. Clougherty and F. G. Anderson, "Theory of Spontaneous Polarization in Endohedral Fullerenes," *Phys. Rev. Lett.* **80**, 3735 (1998).

D. P. Clougherty and X. Zhu, "Stability and Teller's Theorem in Fullerenes," *Phys. Rev. A***56**, 632 (1997).

D. P. Clougherty, "On the Stability of Endohedral Rare Gas Fullerenes," *Invited paper*, *Can. J. Chem.* **74**, 965 (1996).

D. P. Clougherty and J. P. Gorman, "On the Low-Frequency Vibrations of C_{60}," *Chem. Phys. Lett.* **251**, 353 (1996).

J. Freim, J.M. McKittrick, W.J. Nellis, and D.P. Clougherty, "Structural Ceramics Produced Through Post-Sintering of Dynamically Compacted Powder," Proc. Sym. Ceramic Mat., Shanghai, China (1994).

M.E. Eberhart, D. P. Clougherty, and J.M. MacLaren, "Extended Structure and its Relationship to Properties of Intermetallic Alloys," *Phil. Mag. B* **68**, 455-464 (1993).

M.E. Eberhart, D. P. Clougherty, and J.M. MacLaren, "Bonding-Property Relationships in Intermetallic Alloys," *J. Mat. Res.* **8**, 438 (1993).

M.E. Eberhart, D.P. Clougherty, and J.M. MacLaren, "Theoretical Investigations of the Mechanism of Fracture in Metals and Alloys," *J. Am. Chem. Soc.* **115**, 5762 (1993).

J.M. McKittrick, R. Contreras, and D. P. Clougherty, "Aligned Gadolinium Copper Oxide Thick Films Formed by In-Situ Crystallization in a Magnetic Field," *J. Mat. Res.* **8**, 438-448 (1993).

D. P. Clougherty and W. Kohn, "Quantum Theory of Sticking," *Phys. Rev. B* **46**, 4921 (1992).

D. P. Clougherty and W. Kohn, "Low-Energy Behavior of Quantum Adsorption," arXiv:cond-mat/9205004 (1992).

K.H. Johnson, D. P. Clougherty and M.E. McHenry, "Fullerene Superconductivity and the Dynamic Jahn-Teller Effect," *Science* **255**, 1490 (1992).

D. P. Clougherty, M. E. McHenry, J. M. MacLaren, "Magnetism in 4d Transition Metal–Ag(001) Sandwiches," in **Magnetic Thin Films, Multilayers and Surfaces**, H. Hopster, S. S. P. Parkin, G. Prinz, J. P. Renard, T. Shinjo, and W. Zinn, eds. (1991).

M.E. McHenry, J.M. MacLaren, and D.P. Clougherty,"Monolayer Magnetism of 3d Transition Metals in Ag, Au, Pd and Pt Hosts: Systematics of Local Moment Variation," *J. App. Phys.* **70**, 5932 (1991).

M. E. Eberhart, M. M. Donovan, J. M. MacLaren, and D. P. Clougherty, "Towards a Chemistry of Cohesion and Adhesion," *Invited paper*, *Prog. Surf. Sci.* **36**, 1-34 (1991).

J. M. MacLaren, D. P. Clougherty, M. E. McHenry, and M. M. Donovan, "Parameterized Local Spin Density Exchange-Correlation Energies and Potentials for Electronic Structure Calculations. I. Zero Temperature Formalism," *Comp. Phys. Comm.* **66**, 383-391 (1991).

D. Singh, D. P. Clougherty, J. M. MacLaren, R. C. Albers, and C. S. Wang, "Influence of the Local Spin-Density Correlation Functional on the Stability of bcc-Ferromagnetic Iron," *Phys. Rev. B* **44**, 7701-3 (1991).

M.E. Eberhart, D. P. Clougherty, and J.N. Louwen, "Geometrical Origins of Interfacial Strength," *Invited paper*, *Mat. Res. Soc. Bull.*, **16**, 53 (1991).

K.H. Johnson, D. P. Clougherty and M.E. McHenry, "Dynamic Jahn–Teller Theory of High T_c Superconductivity," *Invited paper*, in **High-Temperature Superconductivity: Physical Properties, Microscopic Theory, and Mechanisms**, J. Ashkenazi *et al.*, 341-352 (Plenum Press (1991)).

K. H. Johnson, M. E. McHenry, and D. P. Clougherty, "High T_c Superconductivity in K_xC_{60} Via Coupled $C_{60}(p\pi)$ Cluster Molecular Orbitals and Dynamic Jahn-Teller Coupling," *Physica C* **183**, 319 (1991).

J. M. MacLaren, D. P. Clougherty, and R. C. Albers, "Local Spin-Density Calculations in Iron: Effect of Spin Interpolation on Ground-State Properties," *Phys. Rev. B* (Rapid Comm.) **42**, 3206 (1990).

K. H. Johnson and D. P. Clougherty, "Hydrogen-Hydrogen/Deuterium-Deuterium Bonding in Palladium and the Superconducting/Electrochemical Properties of PdH_x/PdD_x," *Mod. Phys. Lett. B* **3** 795-803 (1989).

K. H. Johnson, D. P. Clougherty, and M. E. McHenry, "Dynamic Jahn-Teller Coupling, Anharmonic Oxygen Vibrations, and High T_c Superconductivity," *Mod. Phys. Lett. B* **3** 1367-74 (1989).

D. P. Clougherty, K. H. Johnson, and M. E. McHenry, "Dynamic Jahn-Teller Coupling and High T_c Superconductivity," *Physica C* **162-164**, 1475 (1989).

K. H. Johnson, D. P. Clougherty, and M. E. McHenry, "Nd, Ce(fπ)-O(pπ) Hybridization in $Nd_{2-x}Ce_xCuO_4$ and Dynamic Jahn-Teller Pairing in High Tc Superconductors," *Mod. Phys. Lett. B* **3** 867-875 (1989).

D. P. Clougherty and K. H. Johnson, "Thermodynamic Critical Fields in High T_c Superconductivity," *Physica C* **153-155** 699 (1988).

PATENTS

D. P. Clougherty and M .E. Eberhart, "Molecular identification and electron resonance system and method." US Patent 7,570,055 B1, granted August 4, 2009.

CONTRIBUTED PRESENTATIONS

"Infrared Problem in a Hybrid System: Ultracold Atoms Coupled to a Vibrating Membrane," American Physical Society, New Orleans, March 2017.

"Infrared Problem in Quantum Acoustodynamics," Frontiers in Nanomechanical Systems, La Thuile, Italy, February 2017.

"Novel Infrared Dynamics of Cold Atoms on Hot Graphene Membranes," American Physical Society, Baltimore, MD, March 2016.

"Self-energy of a Cold Atom Interacting with an Elastic Membrane," American Physical Society, San Antonio, TX, March 2015.

"Quantum Sticking of Atoms on Membranes," American Physical Society, Madison, WI, June 2014.

"Quantum Sticking of Atomic Hydrogen on Graphene," American Physical Society, Baltimore, MD, March 2013.

"Thermal Effects on Quantum Sticking," American Physical Society, Boston, MA, March 2012.

"Breaking Quantum Mirrors with Thermal Fluctuations," American Physical Society, Dallas, TX, March 2011.

"Dissipative Effects on Quantum Sticking," American Physical Society, Dallas, TX, March 2011.

"Theory of Electric Polarization Induced by Inhomogeneity in Crystals," American Physical Society, New Orleans, LA, March 2008.

"Theory of the Jahn-Teller Soliton," American Physical Society, Baltimore, Maryland, March 2006.

"Effective Mass of Vector Polarons," American Physical Society, Baltimore, Maryland, March 2006.

"Theory of the Vector Polaron," Molecular Materials Symposium, Dartmouth College, Hanover, NH, September 2005.

"Anomalous Threshold Laws in Quantum Sticking," American Physical Society, Montreal, Canada, March 2004.

"Vector Polarons in a Degenerate Electron System," American Physical Society, Montreal, Canada, March 2004.

"Endohedral Impurities in Carbon Nanotubes: An Exotic Kondo Liquid," Molecular Materials Symposium, Dartmouth College, Hanover, NH, September 2003.

"Endohedral Impurities in Carbon Nanotubes," American Physical Society, Austin, Texas, March 2003.

"Axial Symmetry Breaking in Carbon Nanotubes," Molecular Materials Symposium, Dartmouth College, Hanover, NH, September 2002.

"Density Functional Theory of van der Waals Interactions," Molecular Materials Symposium, Dartmouth College, Hanover, NH, October 2001.

"Jahn-Teller Effects in Fullerenes, Fullerides and Nanotubes," American Chemical Society, National meeting, San Diego, CA, April 2001.

"A New Mechanism for Ferroelectric Phase Transitions in Molecular Crystals," Molecular Materials Symposium, Dartmouth College, Hanover, NH, January 2001.

"Inversion Symmetry–Breaking in Endohedral Fullerenes," American Physical Society, Los Angeles, CA March 1998.

"Theory of Spontaneous Polarization in Endohedral C_{60}," Humphrey Symposium, University of Vermont, Burlington, VT October 1997.

"Thermal Effects in Quantum Sticking," American Physical Society, Seattle, WA March 1993.

"Dynamic Jahn-Teller Theory of Superconductivity in Ceramics, Organics, and Fullerenes," Materials Research Society, Boston, MA, November 1992.

"Dynamic Jahn-Teller Effects in High T_c Superconductors," Conference on Lattice Effects in High T_c Superconductors, Santa Fe, NM, January 1992.

"Threshold Behavior of Quantum Sticking of Charged Particles on Surfaces," Conference on Surface Interactions of Highly Charged Ions, Institute for Theoretical Physics, UC Santa Barbara, Santa Barbara, CA December 1991.

"Magnetism of 4d-Transition Metal/Ag Sandwiches," Materials Research Society, Anaheim, CA, May 1991.

"Low Energy Behavior of Quantum Sticking," American Physical Society, Cincinnati, OH, March 1991.

"Local Spin-Density Calculations in Fe," American Physical Society, Anaheim, CA, March 1990.

"Investigation of Tip–Surface Interactions in the Atomic Force Microscope: Theory and Experiment," American Physical Society, Anaheim, CA, March 1990.

"Dynamic Jahn-Teller Coupling and High T_c Superconductivity," International Conference on High Temperature Superconductors and Materials and Mechanisms of Superconductivity, Poster Presentation, Stanford University, July 1989.

"Spin Susceptibilities of Clusters and Molecules Using Spin Density Functional Theory," American Physical Society, St. Louis, MO, March 1989.

"Thermodynamic Critical Fields in High T_c Superconductivity," International Conference on High Temperature Superconductors and Materials and Mechanisms of Superconductivity, Poster Presentation, Interlaken, Switzerland, 1988.

"Superconductivity and Magnetism," MIT Industrial Liason Conference on Superconductivity, Cambridge, MA, 1988.

INVITED PRESENTATIONS

"Infrared Problem in Quantum Acoustodynamics," Physics Colloquium, University of Rhode Island, April 2017.

"Quantum of Surprise," University Scholar lecture, University of Vermont, November 2014.

"Dissipation and Decoherence of a Jahn-Teller Impurity in a Solid," XXII International Symposium on the Jahn-Teller Effect, Technische Universität Graz, Austria August 2014.

"Berry-Phase Approach to Electric Polarization and Charge Fractionalization," XX International Symposium on the Jahn-Teller Effect, University of Fribourg, Switzerland August 2010 (with Junren Shi, Di Xiao and Qian Niu).

"Nanoscience and Nanotechnology," ECHO Science Center, Burlington VT April 3, 2010.

"Polarization Induced by Inhomogeneity," Orbital Magnetization in Condensed Matter Workshop, Lausanne, Switzerland June 2009 (with Junren Shi, Di Xiao and Qian Niu).

"Nanoscience and Nanotechnology: Size Matters," Café Scientifique, ECHO Science Center, Burlington VT January 2009.

"Fractional Electrons–It's just a phase they pass through," Department of Physics and Astronomy Colloquium, Dartmouth College November 2008.

"Electron Fractionalization in Jahn-Teller Crystals," XIX International Symposium on the Jahn-Teller Effect, University of Heidelberg, Germany August 2008.

"Quantum Reflection in Sticking and Scattering from Surfaces," Workshop on Quantum Reflection, ITAMP, Harvard University, Cambridge, MA October 2007.

"Novel Multiband Polarons and Solitons," Third International Workshop on Density Functional Theory, Oran, Algeria May 2007.

"Ultracold Atoms at Surfaces: Sticking, Scattering and Quantum Dissipation," University of Texas at Austin, Condensed matter seminar, February 2007.

"Polarons and Solitons in Jahn-Teller Systems," International Centre for Theoretical Physics, Trieste, Italy August 2006.

"Fullerenes and Nanotubes for Mathematicians," Department of Mathematics, University of Vermont, Burlington, Vermont, October 2002.

"The Kondo Effect in a Vibronic System," Department of Physics, McGill University, Montreal, Canada, September 2002.

"Inversion Symmetry Breaking in Endohedral Fullerenes," Department of Physics colloquium, University of Georgia, February 2001.

"Inversion Symmetry Breaking in Endohedral Fullerenes," Condensed Matter Physics seminar, Dartmouth College, October 2000.

"Spontaneous Polarization in Endohedral Fullerenes," Institute for Theoretical Atomic and Molecular Physics, Harvard University, October 1999.

"Vibronic Effects in Fullerenes," Department of Physics Colloquium, University of Iowa, Iowa City, IA, May 1998.

"Vibronic Effects in Fullerenes," Department of Physics Colloquium, Clarkson University, Potsdam, NY April 1998.

"Spontaneous Polarization in Endohedral Fullerenes," Institute for Theoretical Physics, Santa Barbara, CA, May 1997.

"Fullerenes as Quantum Rubber Balls," Department of Physics Colloquium, Rensaeller Polytechnic Institute, March 1996.

"Quantum Mirrors and the Threshold Laws of Atom-Surface Sticking," Condensed Matter Physics Seminar, Harvard University, November 1995.

"C_{60} as a Quantum Rubber Ball," Dept. of Physics Colloquium, University College, Cork (Ireland), October 1995.

"Quantum Mirrors," Dept. of Physics Colloquium, Tulane University, New Orleans, LA November 1994.

"Quantum Mirrors– Reflections of a Cold Atom," Dept. of Physics Colloquium, University of Vermont, Burlington, VT October 1994.

"Sticky Issues in Quantum Sticking," Dept. of Physics Colloquium, Northeastern University, Boston, MA March 1994.

"Sticky Issues in Quantum Sticking," Dept. of Physics Seminar, Cornell University, Ithaca, NY November 1993.

"Universality in Physisorption Kinetics," Dept. of Physics Seminar, Brown University, Providence, RI October 1993.

"Sticky Issues in Quantum Sticking," Dept. of Physics Colloquium, Dartmouth College, Hanover, NH May 1993.

"Sticky Issues in Quantum Sticking," Dept. of Physics Colloquium, Colorado School of Mines, Golden, CO February 1993.

"Topological Approach to Structure and Bonding," Akzo Corporate Research, Dobbs Ferry, NY October 1992

"Sticky Issues in Quantum Sticking," Dept. of Physics Colloquium, University of California– Davis, February 1992.

"Sticky Issues in Quantum Sticking," Dept. of Physics Colloquium, University of California– San Diego, La Jolla, CA November 1991.

"Sticky Issues in Quantum Sticking," Dept. of Physics Colloquium, University of Florida, Gainesville, FL October 1991.

"Dynamic Jahn–Teller Effect and High T_c Superconductivity," Workshop on Mechanisms of High T_c Superconductivity, University of Miami, January 1991.

"Dynamic Jahn–Teller Theory of High T_c Superconductivity," Department of Physics, California State University– Fullerton, March 1990.

"Recent Improvements within the Local Spin Density Approximation with Applications to Magnetic Systems," Fall Symposium on Theory-Assisted Materials Development, Materials Processing Center, MIT, Cambridge, MA, November 1989.

"Vibronic Interactions and Superconductivity: Breakdown of the Born-Oppenheimer Approximation," Center of Materials Science Seminar, Los Alamos National Laboratory, Los Alamos, NM, 1989.

"Molecular Orbital Approach to High Temperature Superconductivity," Center of Materials Science Seminar, Los Alamos National Laboratory, Los Alamos, NM, 1988.

Adrian Del Maestro
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University of Vermont
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Burlington, VT 05405
USA

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Fax: 802-656-0817
Email: adrian@delmaestro.org
URL: http://www.delmaestro.org/adrian/

Education

Ph.D. in Physics, 2008. Thesis: The superconductor-metal quantum phase transition in ultra-narrow wires. Supervisor: Subir Sachdev.
Harvard University, Cambridge, MA, USA

M.S. in Physics, 2005
Yale University, New Haven, CT, USA

M.Sc. in Physics, 2003. Thesis: Quantum spin fluctuations in the Heisenberg-like pyrochlore antiferromagnet gadolinium titanate. Supervisor: Michel Gingras.
University of Waterloo, Waterloo, ON, Canada

B.Sc. in Physics joint with Mathematics, 2002. Graduated summa cum laude.
University of Waterloo, Waterloo, ON, Canada

Professional Experience

Assistant Professor of Physics
University of Vermont (Burlington, VT, USA)
2011–Present

Distinguished Postdoctoral Fellow
Institute for Quantum Matter, Johns Hopkins University (Baltimore, MD, USA)
2010–2011

Postdoctoral Research Scientist
University of British Columbia (Vancouver, BC, Canada)
2008

Research Scientist
Harvard University (Cambridge, MA, USA)
2008– 2008

System Administrator
Harvard University (Cambridge, MA, USA)
2006– 2008

Lab Technician
University of Western Ontario, Brain Research Laboratories (London, ON, Canada)
1999

Publications (30 total, h-index: 15, citations: 597)

1. C. M. Herdman, P.-N. Roy, R.G. Melko and A. Del Maestro, *Entanglement area law in superfluid 4He*, Nature Phys. **4075**, 1 (2017).
2. Adrian Del Maestro and Massimo Boninsegni, *Absence of superfluidity in a quasi-one-dimensional parahydrogen fluid adsorbed inside carbon nanotubes*, Phys. Rev. B **95**, 054517 (2017).
3. C. M. Herdman, P.-N. Roy, R. G. Melko and A. Del Maestro, *Spatial entanglement entropy in the ground state of the Lieb-Liniger model*, Phys. Rev. B **94**, 064524 (2016).

4. M. Motta, D. E. Galli, M. Liebrecht, A. Del Maestro and M. W. Cole, *Quasi-One-Dimensional Electronic States Inside and Outside Helium-Plated Carbon Nanotubes*, J. Low Temp. Phys. **185**, 161 (2016).
5. Nathan S. Nichols, Adrian Del Maestro, Carlos Wexler and Valeri N. Kotov, *Adsorption by design: Tuning atom-graphene van der Waals interactions via mechanical strain*, Phys. Rev. B **93**, 205412 (2016).
6. R. G. Melko, C. M. Herdman, D. Iouchtchenko, P.-N. Roy and A. Del Maestro, *Entangling qubit registers via many-body states of ultracold atoms*, Phys. Rev. A **93**, 042336 (2016).
7. Michael Liebrecht, Adrian Del Maestro and Milton W. Cole, *Quasi-One-Dimensional Electron Gas Bound to a Helium-Coated Nanotube*, J. Low Temp. Phys. **183**, 264 (2016).
8. Pierre-Francois Duc, Michel Savard, Matei Petrescu, Bernd Rosenow, Adrian Del Maestro and Guillaume Gervais, *Critical flow and dissipation in a quasi-one-dimensional superfluid*, Science Adv. **e1400222**, 1 (2015).
9. C. M. Herdman and A. Del Maestro, *Particle partition entanglement of bosonic Luttinger liquids*, Phys. Rev. B **91**, 184507 (2015).
10. C. M. Herdman, S. Inglis, P.-N. Roy, R. G. Melko and A. Del Maestro, *Path-integral Monte Carlo method for Renyi entanglement entropies*, Phys. Rev. E **90**, 013308 (2014).
11. C. M. Herdman, A. Rommal and A. Del Maestro, *Quantum Monte Carlo measurement of the chemical potential of 4He*, Phys. Rev. B **89**, 224502 (2014).
12. C. M. Herdman, P.-N. Roy, R. G. Melko and A. Del Maestro, *Particle entanglement in continuum many-body systems via quantum Monte Carlo*, Phys. Rev. B **89**, 140501 (2014).
13. B. Kulchytskyy, G. Gervais and A. Del Maestro, *Local superfluidity at the nanoscale*, Phys. Rev. B **88**, 064512 (2013).
14. Adrian Del Maestro, Timo Hyart and Bernd Rosenow, *Backscattering between helical edge states via dynamic nuclear polarization*, Phys. Rev. B **87**, 165440 (2013).
15. Adrian Del Maestro, *A Luttinger Liquid Core Inside Helium-4 Filled Nanopores*, Int. J. Mod. Phys. B **26**, 1244002 (2012).
16. James M. Murray, Adrian Del Maestro and Zlatko Tesanovic, *Quantum criticality for extended nodes on a Bethe lattice in the large connectivity limit*, Phys. Rev. B **85**, 115117 (2012).
17. P.A. McClarty, J.N. Cosman, A. Del Maestro and M.J.P. Gingras, *Calculation of the expected zero-field muon relaxation rate in the geometrically frustrated rare earth pyrochlore Gd2Sn2O7 antiferromagnet*, Journal of Physics: Condensed Matter **23**, 164216 (2011).
18. Adrian Del Maestro, Massimo Boninsegni and Ian Affleck, *A Helium-4 Luttinger Liquid in Nanopores*, Phys. Rev. Lett. **106**, 105303 (2011).
19. Adrian Del Maestro, Bernd Rosenow, Jose A. Hoyos and Thomas Vojta, *Dynamical Conductivity at the Dirty Superconductor-Metal Quantum Phase Transition*, Phys. Rev. Lett. **105**, 145702 (2010).
20. Adrian Del Maestro and Ian Affleck, *Interacting bosons in one dimension and the applicability of Luttinger-liquid theory as revealed by path-integral quantum Monte Carlo calculations*, Phys. Rev. B **82**, 060515 (2010).
21. J.-Y. P. Delannoy, A.G. Del Maestro, M.J.P. Gingras and P.C. W. Holdsworth, *Site dilution in the half-filled one-band Hubbard model: Ring exchange, charge fluctuations, and application to La2Cu{1-x}(Mg/Zn)xO4*, Phys. Rev. B **79**, 224414 (2009).
22. Adrian Del Maestro, Bernd Rosenow and Subir Sachdev, *Theory of the pairbreaking superconductor-metal transition in nanowires*, Annals of Physics **324**, 523 (2008).
23. Adrian Del Maestro, Bernd Rosenow, Markus Mueller and Subir Sachdev, *Infinite randomness fixed point of the superconductor-metal quantum phase transition*, Phys. Rev. Lett. **101**, 035701 (2008).
24. Adrian Del Maestro, Bernd Rosenow, Nayana Shah and Subir Sachdev, *Universal thermal and electrical transport near the superconductor-metal quantum phase transition in nanowires*, Phys. Rev. B **77**, 180501 (2008).
25. J.A. Quilliam, K.A. Ross, A.G. Del Maestro, M.J.P. Gingras, L.R. Corruccini and J.B. Kycia, *Evidence for Gapped Spin-Wave Excitations in the Frustrated Gd2Sn2O7 Pyrochlore Antiferromagnet from Low-Temperature Specific Heat Measurements*, Phys. Rev. Lett. **99**, 097201 (2007).

26. Adrian Del Maestro and Michel J.P. Gingras, *Low-temperature specific heat and possible gap to magnetic excitations in the Heisenberg pyrochlore antiferromagnet Gd2Sn2O7*, Phys. Rev. B **76**, 064418 (2007).
27. R.G. Melko, A. Del Maestro and A.A. Burkov, *Striped supersolid phase and the search for deconfined quantum criticality in hard-core bosons on the triangular lattice*, Phys. Rev. B **74**, 214517 (2006).
28. Adrian Del Maestro, Bernd Rosenow and Subir Sachdev, *From stripe to checkerboard ordering of charge-density waves on the square lattice in the presence of quenched disorder*, Phys. Rev. B **74**, 024520 (2006).
29. Adrian Del Maestro and Subir Sachdev, *Thermal melting of density waves on the square lattice*, Phys. Rev. B **71**, 184511 (2005).
30. Adrian G. Del Maestro and Michel J.P. Gingras, *Quantum spin fluctuations in the dipolar Heisenberg-like rare earth pyrochlores*, Journal of Physics: Condensed Matter **16**, 3339 (2004).
31. Ying-Jer Kao, Matthew Enjalran, Adrian Del Maestro, Hamid R. Molavian and Michel J.P. Gingras, *Understanding paramagnetic spin correlations in the spin-liquid pyrochlore Tb2Ti2O7*, Phys. Rev. B **68**, 172407 (2003).
32. R. Del Maestro, R. Shivers, W. McDonald and A. Del Maestro, *Dynamics of C6 Astrocytoma Invasion into Three-dimensional Collagen Gels*, Journal of Neuro-Oncology **53**, 87 (2001).

Conference Proceedings

1. N. Shah, A. Del Maestro, B. Rosenow and S. Sachdev, *Wiedemann-Franz law analysis near a pair-breaking quantum phase transition in superconducting nanowires*, Physica B **403**, 1309 (2008).
2. M. Enjalran, M. J.P. Gingras, Y.-J. Kao, A. Del Maestro and H.R. Molavian, *The spin liquid state of the Tb2Ti2O7 pyrochlore antiferromagnet: a puzzling state of affairs*, Journal of Physics: Condensed Matter **16**, S673 (2004).

Preprints

- A. Del Maestro and M. Boninsegni, *Absence of superfluidity in a quasi one-dimensional parahydrogen fluid adsorbed inside carbon nanotubes*, arXiv:1611.03838 (2016). `https://arxiv.org/abs/1611.03838`
- C. M. Herdman, P.-N. Roy, R. G. Melko and A. Del Maestro, *Entanglement area law in superfluid 4He*, arXiv:1610.08518 (2016). `https://arxiv.org/abs/1610.08518`
- Timothy B.P. Clark and Adrian Del Maestro, *Moments of the inverse participation ratio for the Laplacian on finite regular graphs*, arXiv:1506.02048 (2015). `http://arxiv.org/abs/1506.02048`
- Owen Myers, Adrian Del Maestro, Junry Wu and Jeffery S. Marshall, *A Simple Model for Long-Range Interacting Pendula*, arXiv:1501.04116 (2015). `http://arxiv.org/abs/1501.04116`

Grants Awarded

- **CAREER: Entanglement in Strongly Interacting Quantum Liquids and Gases (DMR1553991)**, NSF, 2016–2021. Award amount: $535,000. `https://www.nsf.gov/awardsearch/showAward?AWD_ID=1553991`
- **Density Functional Theory Calculations of the Transport Properties of CuPc Chains Diluted with H2Pc (DMR140085)**, NSF XSEDE, 2014–2015. Award amount: $14,619.14, 150,000 CPU years.

Awards and Honors

- **Organizers Poster Prize**, International Conference on Quantum Fluids and Solids, Prague, CZ, 2016.
- **College of Arts and Science International Travel Research Award**, University of Vermont, 2013, 2015.
- **Strategic Fellowship**, MITACS, 2010. (Declined)
- **Sugar Award**, One Laptop Per Child, 2007. Children's choice award at the 2007 OLPC Boston Game Jam.
- **Post Graduate Scholarship D**, National Science and Engineering Research Council (NSERC), 2005–2008
- **Dean of Science Award**, University of Waterloo, 2004
- **Excellence in Graduate Studies Award**, University of Waterloo, 2003
- **Alumni Gold Medal**, University of Waterloo Alumni Association, 2003
- **Graduate Teaching Award**, University of Waterloo, 2003
- **Governor General of Canada Silver Medal (Undergraduate)**, Canada, 2002
- **Post Graduate Scholarship A**, NSERC, 2002–2003
- **I.R. Dagg Memorial Scholarship**, University of Waterloo, 2001
- **Undergraduate Research Scholarship**, NSERC, 2001–2001
- **Sony Science Scholarship**, Sony, 2001
- **Science Memorial Scholarship**, University of Waterloo, 2000–2002

Teaching Experience

Instructor
University of Vermont (Burlington, VT, USA)
2011–Present

The Physics of Sports, Fundamentals of Physics II (Electricity and Magnetism), Contemporary Issues in Physics, Classical Mechanics, Computational Physics, Quantum Mechanics, Phase Transitions and Critical Phenomena

Teaching Fellow
Harvard University (Cambridge, MA, USA)
2005– 2008

Teaching Fellow
Yale University (New Haven, CT, USA)
2003–2005

Teaching Assistant
University of Waterloo (Waterloo, ON, Canada)
2000–2003

Invited Presentations

- *Entanglement in the Bose Hubbard Model*, McGill University, Condensed Matter Physics Seminar, Montreal, Canada, September 29, 2016.
- *Entanglement in Quantum Liquids and Gases*, University of Delaware, Condensed Matter Seminar, Newark, DE, April 26, 2016.
- *Low Dimensional Superfluidity*, Dartmouth College, Physics Colloquium, Hanover, NH, January 08, 2016.
- *Entanglement in Quantum Liquids and Gases*, PacificChem 2015, Honolulu, HI, Dcember 18, 2015.
- *Explaining the 2015 Nobel Prize in Physics: Neutrino Oscillations*, University of Vermont, Nobel Prize Explanation Public Lecture, Burlington, VT, November 11, 2015.
- *Entanglement Entropy in Quantum Liquids and Gases*, University of Florida, Condensed Matter Seminar, Gainesville, FL, November 09, 2015.
- *Low Dimensional Superfluidity*, University of California, Irvine, Physics Colloquium, Irvine, CA, October, 22, 2015.
- *Entanglement Entropy in Quantum Liquids and Gases*, Penn State University, Condensed Matter Seminar, University Park, PA, September 22, 2015.
- *Entanglement Entropy in Quantum Liquids and Gases*, Bishops University, Physics Seminar, Lennoxville, QC, Canada, September 18, 2015.
- *Entanglement Entropy in Quantum Liquids and Gases*, University of Ottawa, Condensed Matter Seminar, Ottawa, ON, Canada, September 11, 2015.
- *Dimensional confinement and enhanced coupling in a topologically non-trivial container of superfluid 4He*, 2015 Symposium on Quantum Fluids and Solids, Niagara Falls, NY, August 12, 2015.
- *1D Helium Systems*, Grand Challenges in Quantum Fluids and Solids, Buffalo, NY, August 07, 2015.
- *Particle partitioned entanglement in quantum fluids*, KITP Entangled15, Santa Barbara, CA, April 16, 2015.
- *Quasi-1D Superfluidity*, Physics at the Falls: Phase transitions in reduced dimensions, Buffalo, NY, November 13, 2014.
- *Entanglement Entropy in Quantum Fluids and Gases*, University of Sherbrooke, Physics Colloquium, Sherbrooke, QC, Canada, September 17, 2014.
- *Entanglement Entropy in Quantum Fluids and Gases*, University of Montreal, Condensed Matter Seminar, Montreal, QC, Canada, September 15, 2014.
- *Entanglement Entropy in Quantum Fluids and Gases*, XXVI IUPAP Conference on Computational Physics, CCP2014, Boston, MA, August 13, 2014.
- *Entanglement Entropy in Quantum Fluids and Gases*, Institute for Theoretical Physics, University of Leipzig, Statistical Physics Seminar, Leipzig, Germany, June 25, 2014.
- *Entanglement Entropy in Quantum Fluids and Gases*, 2014 CAP Congress, Sudbury, ON, Canada, June 17, 2014.
- *Low Dimensional Superfluidity*, University of Massachusetts Amherst, Condensed Matter Seminar, Amherst, MA, January 30, 2014.
- *Quantum Nanofluidics*, Bishops University, Physics Seminar, Lennoxville, QC, Canada, October 3, 2013.
- *Local Superfluidity at the Nanoscale*, QFS 2013: International Symposium on Quantum Fluids and Solids, Matsue, Japan, August 01-06, 2013.
- *Superfluidity in Low Dimensional Quantum Fluids*, Canada Theory 8, Lennoxville, QC, Canada, May 23, 2013.

- *Backscattering Between Helical Edge States via Dynamic Nuclear Polarization*, University of British Columbia, Condensed Matter Seminar, Vancouver, BC, Canada, May 16, 2013.
- *Quantum Nanofluidics*, University of Alberta, Physics Colloquium, Edmonton, AB, Canada, January 21, 2013.
- *A Luttinger Liquid Core Inside Helium-4 Filled Nanopores*, University of Oklahoma, Condensed Matter Seminar, Norman, OK, November 02, 2012.
- *Giving Scientific Presentations*, University of Vermont, Graduate Student Senate Professional Development Series, Burlington, VT, October 11, 2012.
- *A Luttinger Liquid Core Inside Helium-4 Filled Nanopores*, Trent University, Physics and Chemistry Colloquium, Trent, ON, Canada, September 26, 2012.
- *Scientific Computing With Python*, Vermont Code Camp, Burlington, VT, September 22, 2012.
- *Worm Algorithm Quantum Monte Carlo*, International Summer School on New Trends in Computational Approaches for Many-Body Systems, Sherbrooke, Quebec, Canada, May 28 - June 8, 2012.
- *A Luttinger Liquid Core Inside Helium-4 Filled Nanopores*, Institute for Theoretical Physics, Theoretical Physics Seminar, University of Leipzig, Leipzig, Germany, March 08, 2012.
- *A Luttinger Liquid Core Inside Helium-4 Filled Nanopores*, Missouri University of Science and Technology, Physics Colloquium, Rolla, MO, January 26, 2012.
- *A Luttinger Liquid Core Inside Helium-4 Filled Nanopores*, University of Alberta, Condensed Matter Physics Seminar, Edmonton, AB, Canada, December 08, 2011.
- *A Luttinger Liquid Core Inside Helium-4 Filled Nanopores*, McGill University, Condensed Matter Physics Seminar, Montreal, QC, Canada November 03, 2011.
- *Dynamical Conductivity at the Dirty Superconductor-Metal Quantum Phase Transition*, National High Magnetic Field Laboratory, Seminar, Florida State University, Tallahassee, FL, March 04, 2011.
- *Luttinger Liquids in Nanopores*, University of Vermont, Physics Colloquium, Burlington, VT, March 02, 2011.
- *Quantum Monte Carlo Studies of Luttinger Liquids*, George Mason University, Fairfax, VA, November 29, 2010.
- *Quantum Monte Carlo Studies of Luttinger Liquids*, Condensed Matter Theory Center, University of Maryland, College Park, MD, November 16, 2010.
- *Dynamical Transport at the dirty Superconductor-Metal Transition*, Institute for Quantum Matter, Johns Hopkins University, Baltimore, MD, February 12, 2010.
- *Quantum Monte Carlo Studies of Luttinger Liquids*, Max-Planck Institute, Stuttgart, Germany, January 27, 2010.
- *Quantum Monte Carlo Studies of Luttinger Liquids*, University of Cologne, Cologne, Germany, January 22, 2010.
- *Quantum Monte Carlo Studies of Luttinger Liquids*, Brookhaven National Lab, Upton, NY, December 21, 2009.
- *Electrical Transport and Infinite Randomness at the Superconductor-Metal Transition*, McGill University, Montreal, QC, Canada, December 09, 2009.
- *Electrical Transport and Infinite Randomness at the Superconductor-Metal Transition*, Simon Fraser University, Burnaby, BC, Canada, September 30, 2009.
- *Quantum Phase Transitions*, Canadian Institute for Advanced Research Summer School, Vancouver, BC, Canada, May 25, 2009.
- *Infinite Randomness at the Superconductor-Metal Quantum Phase Transition*, University of California, Los Angeles, CA, April 29, 2009.
- *Infinite Randomness at the Superconductor-Metal Quantum Phase Transition*, Max-Planck Institute, Stuttgart, Germany, February 26, 2009.
- *Infinite Randomness at the Superconductor-Metal Quantum Phase Transition*, Caltech, Pasadena, CA, October 10, 2008.
- *Infinite Randomness at the Superconductor-Metal Quantum Phase Transition*, Quantum Critical Phenomena: Statics and Dynamics, Conference, Toronto ON, Canada, September 26, 2008.
- *Infinite Randomness at the Superconductor-Metal Quantum Phase Transition*, University of Frankfurt, Frankfurt, Germany, June 23, 2008.
- *Universal Thermoelectric Transport and Activated Dynamic Scaling in Nanowires*, Microsoft Station Q, Santa Barbara, CA, February 06, 2008.
- *Universal Thermoelectric Transport and Activated Dynamic Scaling in Nanowires*, University of British Columbia, Vancouver, BC, Canada, January 30, 2008.
- *Universal Thermoelectric Transport and Activated Dynamic Scaling in Nanowires*, University of Toronto, Toronto, ON, Canada, November 23, 2007.
- *Thermoelectric Transport in the Vicinity of a Superconductor-Metal Quantum Phase Transition in Nanowires*, MIT, Cambridge, MA, April 11, 2007.
- *From Stripe to Checkerboard Order on the Square Lattice*, Boston University, Boston, MA, November 02, 2006.

- *From Stripe to Checkerboard Order on the Square Lattice*, Materials Science and Technology Division, Oak Ridge National Lab, Oak Ridge, TN, July 12, 2006.
- *Thermal Melting of Density Wave Order on the Square Lattice*, University of Waterloo, Waterloo, ON, Canada, December 22, 2005.
- *Thermal Melting of Density Wave Order on the Square Lattice*, University of California, Santa Barbara, December 03, 2004.

Contributed Presentations

- *Dissipation in Nanoscale Superfluids*, APS March Meeting, Baltimore, MD, March 17, 2016.
- *Dissipative Neutral Mass Flow and Quantum Phase Slips in One Dimension*, APS March Meeting, San Antonio, TX, March 04, 2015.
- *Dimensional Crossover in Quantum Fluids*, APS March Meeting, Denver, CO, March 06, 2014.
- *Backscattering Between Helical Edge States via Dynamic Nuclear Polarization*, APS March Meeting, Baltimore, MD, March 21, 2013.
- *Quantum Criticality on Graphs*, APS March Meeting, Boston, MA, March 01, 2012.
- *A Luttinger liquid Core Inside Helium-4 Filled Nanopores*, APS March Meeting, Dallas, TX, March 25, 2011.
- *Quantum Monte Carlo Studies of Luttinger Liquids*, APS March Meeting, Portland, OR, March 19, 2010.
- *Thermal and Electrical Transport in a Random Dissipative Quantum System Controlled by an Infinite Randomness Critical Point*, APS March Meeting, New Orleans, LA, March 11, 2008.
- *Thermoelectric Transport in the Vicinity of a Superconductor-Metal Quantum Phase Transition in Nanowires*, APS March Meeting, Denver, CO, March 06, 2007.
- *The Dimensionality of Charge Density Waves in the Presence of Quenched Disorder*, APS March Meeting, Baltimore, MD, March 14, 2006.
- *Thermal Melting of Density Wave Order on the Square Lattice*, APS March Meeting, Los Angeles, CA, March 23, 2005.
- *Spin Fluctuations in the Presence of Competing Dipolar and Zeeman Interactions*, APS March Meeting, Montreal, QC, Canada, March 22, 2004.

Mentoring

- Postdoctoral Researchers (2):
  Dr. Hatem Barghathi, (2016 - Present).
  Dr. Chris Herdman, (2012 - 2014).
- Ph.D. Students:
  Nathan Nichols, Materials Science (September 2015 - Present).
  Ben Himberg, Physics (September 2016 - Present).
- MS Students (2 graduated, 2 current):
  Emanuel Casiano-Diaz, Physics (2016 - Present).
  Ben Himberg, Physics (2014 - Present).
  Dan Burrill, Physics (graduated Spring 2015).
  Max Graves, Materials Science (graduated Fall 2014).
- Undergraduate Research Students (12):
  Renee Beneski, UVM Physics, (2016-Present).
  Zhenya Rock, UVM Mathematics, (2015).
  Joshuah Heath, UVM Physics, (2014 - 2015).
  Christopher Martin (co-advised with G. Gervais), McGill University, (2013 - 2014).
  Dan Allman, UVM Physics, (2013 - 2015).
  Kyle Robertson, UVM Physics and Honors College, (2013 - 2015).
  Bohdan Kulchytskyy (co-advised with G. Gervais), McGill University, (2012 - 2013).
  Colin Campbell, Complex Materials REU student, (2013).
  Andrea Rommal, Complex Materials REU student, (2012).
  Evan Border, UVM Physics and Honors College (2011 - 2012).
  Ben Ponedel, Materials Science REU student, Johns Hopkins University (2011).
  Jacob Cosman, NSERC of Canada research scholarship recipient, University of Waterloo (2007 - 2009).
- High School Researchers(2):
  Reeve Flynn, Burlington High School (2016).
  Jacquelyn Moreno, Harwood Union High School (2015).

Professional Service

- American Physical Society March Meeting 2010 Abstract Sorter.
- Referee for *Physical Review B*, *Physical Review Letters*, *New Journal of Physics*, *Journal of Physics: Condensed Matter*, *Physica B* and *Computational Physics Communications*.
- Chaired Sessions:
  Strongly Correlated Electrons Theory III, APS March Meeting (2013).
  Disordered and other Strongly Correlated Systems, APS March Meeting (2012).
  Low D/Frustrated Magnetism - Quantum Magnetism, APS March Meeting (2011).

University Service

- Vermont Advanced Computing Core Steering Committee, (2014 - Present)
- College of Arts and Sciences Academic Studies Committee (2013 - Present)
- Physics Hiring Committee (2013 - 2016)
- Co-Chair Physics Graduate Studies Committee (2013 - Present)
- Physics Graduate Studies Committee (2012 - 2013)
- Physics Colloquium Committee (2011 - Present)

Service

- Invited Lecturer: (2012, 2014, 2016) Computational methods for quantum materials, Sherbrooke, QC, Canada. Presented pedagogical lectures on modern quantum Monte Carlo methods employing the path integral formalism to a diverse group of graduate students. Lecture notes and sample programs are available online.
  `https://github.com/agdelma/pimc-notes`
- Developer: open source worm algorithm path integral quantum Monte Carlo code which is freely available, allowing for the study of thousands of strongly interacting bosons in the grand canonical ensemble.
  `http://code.delmaestro.org`
- Particpant: Burlington High School *Science in Society* Year End Studies (YES) program where I gave a series of introductory lectures on superconductivity (2013-Present).
- Organizer of the Harvard Condensed Matter Theory Kids Seminar, a weekly graduate student seminar with the goal of fostering learning in a non-threatening colloquium setting (2006 - 2008).

Last modified Dec 2016.

MADALINA I. FURIS

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EDUCATION

UNIVERSITY AT BUFFALO, STATE UNIVERSITY OF NEW YORK, Buffalo, New York
Ph. D in Physics, February 2004
Advisors: Professors Bruce D. McCombe and A. N. Cartwright – Center for Advanced Electronic and Photonic Materials (CAPEM) and the Laboratory for Spectroscopic Evaluation (LASELAB)
Thesis: "Time –Resolved Photoluminescence Spectroscopy of Nitride Emitters"

UNIVERSITY OF BUCHAREST, Bucharest, Romania
M.S in Semiconductor Physics, June 1997
Advisor: Professor Ioan Licea-Faculty of Physics, Division of Solid State Physics
Thesis: "Hot Electrons Distribution Function and Breakdown Ionization in Semiconductors"

UNIVERSITY OF BUCHAREST, Bucharest, Romania
B.S in Solid State Physics, June 1996
Advisor: Professor Ioan Licea-Faculty of Physics, Division of Solid State Physics Thesis:
"Poole-Frankel Effect in Amorphous Chalcogenides"

Professional Society Affiliations:

American Physical Society, Materials Research Society, SPIE

EXPERIENCE

UNIVERSITY OF VERMONT –MATERIALS SCIENCE PROGRAM Oct 2013 - present

- Program Director

UNIVERSITY OF VERMONT-PHYSICS DEPARTMENT May2012 - present
Associate Professor

- Magneto-optical microscopy studies of electron states in organic semiconductors
- Spectroscopy studies of excitons in crystalline organic semiconductors
- Spin-dependent and ultrafast phenomena in electronic materials
- Optical Spectroscopy techniques development in very high magnetic fields

UNIVERSITY OF VERMONT-PHYSICS DEPARTMENT Aug. 2006-May 2012
Assistant Professor

NATIONAL HIGH MAGNETIC FIELD LABORATORY-LOS ALAMOS Mar. 2004- Aug. 2006
Post-Doctoral Associate – Optics and Lasers Operations
Supervisor: Dr. Scott A. Crooker

- Mapping the exciton fine structure in CdSe colloidal nanocrystals through CW and timeresolved photoluminescence spectroscopy in high magnetic fields (< 33T).
- Imaging spin currents in ferromagnet-semiconductor lateral spin transport devices using magneto-optical Kerr effect spectroscopy.
- Operation of DC superconducting magnets, CW and ultrafast lasers.

UNIVERSITY AT BUFFALO, STATE UNIVERSITY OF NEW YORK Sept. 2001-Feb. 2004
Research Assistant – Institute for Lasers, Photonics and Biophotonics and the Center for Advanced Photonics and Electronics Materials (CAPEM)
Advisors: Dr. A. N. Cartwright and Dr. Bruce. D. McCombe

- Continuous wave and ultrafast optical properties of GaN/AlN quantum well heterostructures and AlGaN epilayers
- Alignment and maintenance of the CAPEM ultrafast laser facility (Ti-sapphire oscillator, regenerative amplifier, OPAs)
- CW and time-resolved photoluminescence studies of GaP and InP nanoparticles grown by colloidal chemistry (a collaboration with the Institute for Lasers, Photonics, and Biophotonics at UB).
- Market analysis and scientific evaluation of a laser spectrum analyzer system (a collaboration with the UB Technology Incubator and Imaging and Sensing Technologies, PI: A.N. Cartwright)

UNIVERSITY AT BUFFALO, STATE UNIVERSITY OF NEW YORK Jan. 1999-Sept. 2001
Research Assistant- Center for Advanced Photonics and Electronics Materials Advisors: Dr. Athos Petrou and Dr. Bruce D. McCombe.

- Magneto-photoluminescence, reflection and transmission studies of ferromagnetic GaAs/Mn digital layers and Mn –doped GaAs epilayers grown by molecular beam epitaxy.(DARPA SpinS-Program- PI: Dr. Bruce D. McCombe)
- Magneto-photoluminescence and electroluminescence studies of recombination mechanisms in ZnMnSe/GaAs/AlGaAs Spin-LED's.
- Optically detected resonance experiments on diluted magnetic II-VI semiconductors: internal transitions of negatively charged excitons and spin flip transitions in CdTe and CdMnTe quantum wells.

UNIVERSITY AT BUFFALO, STATE UNIVERSITY OF NEW YORK Sept.1997-Jan. 1999
Teaching Assistant – Physics Department

Teaching Assignments:

Fall '06 PHYS 11- College Physics 1 (recitation)
Spring '07 PHYS 296-Physical Optics (Lecture- New Course)

Fall ’07 PHYS 214- Electromagnetism II (Lecture)
Fall’07 PHYS 42 Physics for Engineers II (Recitation)
Fall ’07 PHYS 21 Introductory Laboratory
Spring’ 08 PHYS 213 Electromagnetism I (Lecture)
Spring ’08 PHYS 31 Physics for Engineers I (Recitation)
Fall '08 PHYS 214 Electromagnetism II (Lecture)
Fall '08 PHYS 51 - Intro Phys for Physics Majors (Recitations and Labs, New Course)
Spring '09 PHYS 213 Electromagnetism I (Lecture)
Fall '09 PHYS 51 - Intro Phys for Physics Majors (Lectures and Labs)
Fall '09 PHYS 196- Contemporary Issues in Physics (Lecture-New Course)
Spring’10 PHYS 196/296 Physical Optics (Lecture)
Fall ’10 PHYS 51 – Intro Phys for Physics Majors (Lectures, Labs and Recitations)
Spring ’11 PHYS 242 Introduction to Solid State Physics (Lectures)
Spring ’11 PHYS 196 Contemporary Issues in Physics (Lectures)
Spring ’11 PHYS 351 Seminar on Properties of Materials (Lectures)
Fall `11 PHYS 51 – Intro Phys for Physics Majors (75 students) (Lectures, Labs and Recitations)
Spring ’12 PHYS 296 Physical Optics (Lectures)
Fall ’12 PHYS 213 Electromagnetism I (Lecture)
Fall ‘12 PHYS 11- College Physics 1 (recitation)
Spring ’13 PHYS 242 Introduction to Solid State Physics (Lectures)
Fall ’13 PHYS 213 Electromagnetism I (Lecture)
Fall ’14 PHYS 128 Introductory Modern Physics (20 students) (Lectures & Labs)
Spring ’15 PHYS 242 Solid State Physics (20 students)
Fall’15 PHYS 51 Intro Phys for Physics Majors (69 students)
Fall’ 16 PHYS 51 Intro Phys for Physics Majors (69 students)
Spring ’17 PHYS 242 Solid State Physics (18 students)

MEMBERSHIP IN THESIS COMMITTEES

Hua Zhang (PhD Materials Science -UVM)
Konstantin Afanasyev (Masters in Physics-UVM)
Nathan Mahany (Masters in Medicinal Chemistry-UVM)
Songtao Wo (PhD Material Science-UVM)
Lan Zhou (PhD Material Science –UVM)
Lyndelle LeBruin (Masters Chemistry-UVM)
Benjamin Knight (MS Physics UVM)
Ishviene Cour (PhD Material Science-UVM)
Jacob Whalen Strothman (Honors Thesis, B. S. Physics- UVM)
Amanda Graves (Chemistry, PhD)
Abi Ruksznis (Geology BS 2013)
Daniel Burrill (Physics, MS)
Matthew Conger (PhD Chemistry –UVM)
Daniel DePuccio (PhD Chemistry-UVM)

ADVISEES

Kim Ngan Hua (PhD Materials Science UVM)
Libin Liang (PhD Materials Science -UVM)
Michael Arnold (UVM Physics major)
Katy Czar (UVM Physics major)

FORMER ADVISEES

Lane Manning (PhD 2016 Material Science-UVM- now at Semrock inc)
Naveen Rawat (PhD 2015 Materials Science –UVM)
Zhenwen Pan (PhD 2012 Material Science –UVM) currently with CGGVeritas
Margaret Sutton (BS Physics-UVM) (research mentor)
Christopher Gordon Libby (BS Physics-UVM) (research mentor)
Eli Kinigstein (BS Physics-UVM) (summer experience mentor) currently at Columbia Univ.
Lane Manning (BS Physics -UVM- URECA awardee) (research mentor)
Erik Horak (BS Physics/Chemistry-UVM- REU awardee) currently at U. Wisconsin Maddison
Roy Anderson (BS Physics –UVM- REU awardee)
Lauren Paladino (BS Physics- Univ. of South Florida REU awardee)
Jacob Whalen Strothman (B. S. Physics- UVM co-advised with K. Chu) now at Rice Univ.
Cody Lamarche (BS Physics –UVM-Honors College Summer Research and REU awardee) now at Cornell Univ.
Matt DiMario (BS Physics -UVM) now at University of New Mexico
Alice Perrin (BS Physics- College of William and Mary REU awardee) now at Carnegie Mellon
Nick Gould (Cornell University REU awardee)
Derrick Butler (BS Physics-UVM)
Victoria Ainsworth (BS Physics-UVM)

DEPARTAMENT AND COLLEGE ACTIVITIES

2006-2007	Physics Department Chair search committee member
2007-2008	Physics Colloquium Committee Chair
2007	Participant in the Material Science Program review
2007-2008	Member in the CAS Faculty Development Award proposal review panel
Feb 2008	Attended the APS Conference on graduate education
2008-2009	Member in the Faculty Search Committees for the Theoretical and Experiment Condensed Matter Physics Assistant Professor Faculty positions
2008-present	Physics Colloquium co-organizer
2008-2011	Member in the CAS APLE, Suiter and Faculty Development award proposal review panels (Fall and Spring semesters)
2010-2011	Member in the Faculty Search Committees for the Computational Physics Assistant Professor faculty positions
2011-present	Member in the CAS Elections Committee (Committee Chair for Spring 2013)

2012-2013 Member in the Lecturer and Lab Coordinator Search Committees
2013-2014 Member in the Faculty Search Committee for the Experimental Condensed Matter Faculty position
2013-2015 Member in the STEM building design committee
2013-present Director, Materials Science Program
2014-2015 Member in the Faculty Search Committee for the Experimental Condensed Matter Faculty position
Spring 2015 Chair of Elections and Nominations Committee
2006-present Member in colloquium committee

SYNERGISTIC ACTIVIES

- Jumpstarted the Women in Physics Club at UVM (Fall '08)
- Organized and ran the Physics and Material Science Journal Club at UVM (Fall '08/spring '09)
- Participated in the *"Spin Electronics"* proposal review panel at NSF (ECCS division March '07)
- Member of the National High Magnetic Field (NHMFL) Users Committee since fall '07.
- Member of the National High Magnetic Field Laboratory (NHMFL) Users Executive Committee since Fall '08
- Member of the Graduate Faculty at the University of Vermont since Fall '06.
- Co-organizer of the *"Optical Spectroscopy in the Florida Helix"* Workshop hosted at the National High Magnetic Field Laboratory in Tallahassee Florida, Oct 1st 2009
- Ad-hoc proposal reviewer for NSF –DMR division
- Ad-hoc reviewer for Physical Review Letters and Physica E
- Participated in the *"Research in Undergraduate Institutions"* proposal review panel at NSF (DMR division- March 2011)
- Participated in the *"Electronic and Photonics Materials and Devices"* proposal review panel at NSF (ECCS-division April 2011)
- Participated in the "Scientist in Residence" program at the Jericho Elementary School (Feb 2013)
- Prepared and delivered a presentation to the Weekly physics colloquium entitled "So, you think you know what you'll do after graduation…" that offers career guidance and advice for physics and engineering students. (Sept 2013)
- Participated in the DMR CMP proposal review panel at NSF (February 2015)
- Served as NHMFL User Executive Committee Vice Chair (since Oct 2014)
- Organized and Mentored the University of Vermont Materials Research Society (MRS) Chapter
- Organized the Materials Science Session at the UVM student Research Conference in April 2015
- Member in the MRSEC NSF –site review committee (Spring 2015)
- Member in the NSF-DMR-MRI proposal panel review (Spring 2015)
- Ad-hoc proposal reviewer for the User Collaborative Proposal program of the National High Magnetic Field Lab

- Organized the AMEBA (Advanced Materials for Energy and Bioengineering Applications) International Workshop at the University of Vermont (December 2015)
- Participated in outreach Nanodays activities at the Echo Center in Burlington VT
- Organized Advanced Next Generation Energy Leadership (ANGEL) symposium at the University of Vermont (October 2016)
- Organized outreach activities with the MRS Chapter (Science Fair at Winooski Middle School)
- Member in the NSF-EPM proposal panel review (Spring 2017)

EXTRAMURAL FUNDING

1. **"MRI: Acquisition of Magneto-Optical Microscopy Instrumentation for Research and Education**" **PI-Madalina Furis** Co-Pis: Kelvin Chu, Randall Headrick and Daniel Savin $242, 539 (NSF-share) sept 2008 –aug 2010 NSF –DMR# 0821268
2. **"CAREER: Imaging Excitons, Spin Coupling and Magnetism in Discotic Crystalline Organic Semiconductors" PI: Madalina Furis** $600,000 (march 2011-feb 2017) NSFDMR #1056589
3. **"REU SITE: Undergraduate Research on Complex Materials" PI: Dennis Clougherty, Co-PI: Madalina Furis $** 190,000 NSF-DMR #1062966 (april 2011-march2014)
4. **"MRI: Development of a Free Space Optical Spectroscopy System for Chemistry, Material Science and Biophysics Research and Education in the 25-T Split Coil Helix" PI: Stephen McGill, Co-PIs: Madalina Furis (UVM) David Hilton (Univ. of Alabama) and Gregory Scholes (Princeton Univ.)** $146,907 (UVM share) 01/01/13-12/31/14
5. **National High Magnetic Field Laboratory Visiting Scientist Program Award** $5,000
6. **"Exciton Delocalization in Small Molecule Semiconductors Thin Films" PI: Madalina Furis, Co-PI: Rory Waterman (UVM)** $461,6122 07/01/17-06/30/20 (NSF-DMR PENDING)
7. **"Bio Inspired Organic Semiconductors for Sustainable Electronics" PI: Madalina Furis, Co-PI: Matthew White** 01/04/16-31/08/17 $ 36,128 (UVM-OVPR-REACH program PENDING)

PUBLICATIONS

Book Chapters:

1. "*Quantum Dot Devices*", M. Furis and A. N. Cartwright, in *Encyclopedia of Optical Engineerin*g, Marcel Dekker Inc., New York, pp. 2188-2196 (2003).

Peer –Reviewed Journals: (h-index 15, citations 1001)

1. "*Exciton Delocalization in $H_2OBPc_{1-x}MOBPc_x$ (M = Co, Cu, Ni, Mn) Crystalline Thin Film Organic Alloys",* L. W. Manning, N. Rawat, C. Lamarche, R. Waterman, R. L. Headrick, M. Furis, J. Phys. Chem. C **120,** 11966 (2016) (impact factor 4.9)
2. "*Spin Exchange Interaction in Substituted Copper Phthalocyanine Crystalline Thin Films"*, N. Rawat, Z. Pan, C. J. Lamarche, A. Wetherby, R. Waterman, T. Tokumoto, J. G. Cherian, R. L. Headrick, S. A. McGill and M. Furis, Sci. Rep. **5,** 15536 (2015). (impact factor 5.6) (2 citations)
3. *"Polarization- Resolved Spectroscopy Imaging of Grain Boundaries and Optical Excitations in Crystalline Organic Thin Films*", Z. Pan, N. Rawat, I. Cour, L. W. Manning, R. L. Headrick and M. Furis, Nat. Commun. **6**, 8201 (2015) (impact factor 11.5) (3 citations)
4. "*Macroscopic Molecular Ordering and Exciton Delocalization in Crystalline Phthalocyanine Thin Films*", N. Rawat, Z. Pan, L. W. Manning, C. Lamarche, I. Cour, R. Waterman, R. L. Headrick, A. Woll and M. Furis, J. Phys. Chem. Lett. **6,** 1834-1840 (2015) (impact factor 7.5) (7 citations)
5. *"Selective Orientation of Discotic Films by Interface Nucleation"*, I. Cour*, Z. Pan*, L. T. Lebruin*, M. A. Case, M. Furis and R. L. Headrick, Organic Electronics **13**, 419 (2012). (8 citations)
6. ***"****Magnetic Circular Dichroism (MCD) in the Split Magnet: Bridging Quantum Chemistry to Solid State Physics*" (invited cover story) Z. Pan, N. Rawat, C. Lamarche. T. Tokumoto, D. Semenov, M. Furis and S. McGill Mag Lab Reports **18**, 14-16 (2011)
7. *"Radiative lifetimes and orbital symmetry of electronic energy levels of CdS nanocrystals: Size dependence",* B. Yang, J. E. Schneeloch, Z. Pan, M. Furis and M. Achermann, Phys. Rev. B **81**, 073401 (2010) (29 citations, impact factor 3.1)
8. *"Anomalous Circular Polarization of Photoluminescence Spectra of Individual CdSe Nanocrystals in an Applied Magnetic Field"* H. Htoon, S. A. Crooker, M. Furis, S. Jeong, Al. L. Efros, and V. I. Klimov, Phys Rev. Lett **102**, 017402 (2009). (24 citations, impact factor 7)
9. *"Linearly Polarized 'Fine Structure' of the Bright Exciton State in Individual CdSe Nanocrystal Quantum Dots"* H. Htoon, M. Furis, S. A. Crooker, S. Jeong, and V. I. Klimov Phys. Rev B **77**, 035328 (2008). (24 citations, impact factor 3.1)
10. *"Local Hanle-effect studies of spin drift and diffusion in n: GaAs epilayers and spintransport devices" (invited)* M. Furis, D. L. Smith, S. Kos, E. S. Garlid, K. S. M.

Reddy, C. J. Palmstrøm, P. A. Crowell, and S. A. Crooker, New J. Phys. **9**, 347 (2007) (35 citations, impact factor 3.3)

11. *"Optical and electrical spin injection and spin transport in hybrid Fe/GaAs devices",* S. A. Crooker, M. Furis, X. Lou, P. A. Crowell, D. L. Smith, C. Adelmann, and C. J. Palmstrøm, J. Appl. Phys. **101**, 081716 (2007) (13 citations, impact factor 2.3)
12. *"Bias-Dependent Electron Spin Lifetimes in n-GaAs and the Role of Donor Impact Ionization",* M. Furis, D. L. Smith, S. A. Crooker, and J. L. Reno, Appl. Phys. Lett. **89**, 102102 (2006). (27 citations, impact factor 4)
13. *"Bright Exciton Fine- Structure and Anisotropic Exchange in CdSe Nanocrystal Quantum Dots",* M. Furis, S. A. Crooker, T. D. Barrick, M. Petruska, V. I. Klimov, Phys. Rev. B **73**, 241313 (2006) (32 citations, impact factor 3.1)
14. *"Electrical Detection of Spin Accumulation at a Ferromagnet-Semiconductor Interface",* X. Lou, C. Adelmann, M. Furis, S. A. Crooker, C. J. Palmstrøm, and P. A. Crowell, Phys. Rev. Lett. **96**, 176603 (2006) (127 citations, impact factor 7)
15. *"Excitons in Carbon Nanotubes with Broken Time-Reversal Symmetry",* S. Zaric, G. N. Ostojic, J. Shaver, J. Kono, O. Portugall, P. H. Frings, G. L. J. A. Rikken, M. Furis, S.A. Crooker, X. Wei, V. C. Moore, R. H. Hauge, and R.E. Smalley, Phys. Rev. Lett. **96**, 016406 (2006). (84 citations, impact factor 7)
16. *"Imaging Spin Injection and Accumulation in Lateral Ferromagnet/Semiconductor Devices",* S. A. Crooker, M. Furis, X. Lou, C. Adelmann, D. L. Smith, C. J. Palmstrøm, and P. A. Crowell, Science **309**, pp.2191-2195 (2005). (222 citations, impact factor 30)
17. *"Magneto-Optical Spectroscopy of Carbon Nanotubes",* S. Zaric, G. N. Ostojic, J. Shaver, J. Kono, X. Wei, M. Furis, S. A. Crooker, O. Portugall, P. H. Frings, G. L. J. A. Rikken, V. C. Moore, R. H. Hauge, and R. E. Smalley, Physica E **29**, pp. 469-474 (2005). (8 citations, impact factor 1)
18. *"Time and Polarization-Resolved Optical Spectroscopy of Colloidal CdSe Nanocrystal Quantum Dots in High Magnetic Fields",* M. Furis, J. Hollingsworth, V. I. Klimov, and S. A. Crooker, J. Phys. Chem. B **109**, pp.15332-15338 (2005). (33 citations, impact factor 4.1)
19. *"Mono-dispersed InP Quantum Dots Prepared By Precursor Based Colloidal Chemistry in a Non-coordinating Solvent*", D. W. Lucey, D. J. MacRae, M. Furis, Y. Sahoo, A. N. Cartwright, P. N. Prasad , Chem. Mat. **17**, pp. 3754-3762 (2005). (76 citations, impact factor 5.1)
20. *"Growth of InN on Ge Substrates by Molecular Beam Epitaxy*", E. Trybus, G. Namkoong, W. Henderson, W. A. Doolittle, R. Liu, J. Mei, F. Ponce, M. Cheung, F. Chen, M. Furis, and A. Cartwright, J. Cryst. Growth, **279**, pp. 311-315 (2005). (13 citations, impact factor 1.8)
21. *"Spectral and Temporal Evolution of Recombination from Multiple Excitation States in Modulation Doped AlGaN/GaN Multiple Quantum Well Heterostructures",* M. Furis, A. N. Cartwright, E. L. Waldron, and E. F. Schubert, Appl. Phys. Lett. 86, pp.162103 (2005). (1 citation impact factor 4)
22. *"Exciton Spin States in Nanocrystal Quantum Dots Revealed by Spin-Polarized Resonant Photoluminescence and Raman Spectroscopy"*, M. Furis, T. Barrick, S. A. Crooker, M. Petruska, V. Klimov, and Al. L. Efros, Intl. J. Mod. Phys B 18, pp. 3769-3774 (2004). (4 citations, impact factor 0.4)

23. "*Room Temperature UV Emission from GaN/AlN Multiple Quantum Well Heterostructures*", M. Furis, A. N. Cartwright, H. Wu, and W. J. Schaff, Appl. Phys. Lett. **83**, pp.3486-3488 (2003). (21 citations, impact factor 4)
24. "*Many Body Effects and Internal Transitions of Confined Excitons in GaAs and CdTe Quantum Wells*", C. J. Meining, H. A. Nickel, A. B. Dzyubenko, A. Petrou, M. Furis, D. R. Yakovlev, and B. D. McCombe, Solid State Comm. **127,** pp. 821-827 (2003). (1 citation, impact factor 1.5)
25. "*Surfactant-Imposed Interference in the Optical Characterization of GaP Nanocrystals*", M. Furis, A. N. Cartwright, Y. Sahoo, D. J. MacRae, and P. N. Prasad, J. Phys. Chem B **107**, pp.11622-11625 (2003). (9 citations, impact factor 4.1)
26. "*Optical phonon spectra of GaP nanoparticles*", F. S. Manciu, Y. Sahoo, D. J. MacRae, M. Furis, B. D. McCombe, and P. N. Prasad, Appl. Phys. Lett. **82**, pp. 4059-4061 (2003). (11 citations, impact factor 4)
27. **"***Ultrafast Differential Transmission Spectroscopy of Excitonic Transitions in InGaN/GaN Multiple Quantum Wells*", F. Chen, M. C. Cheung, P. M. Sweeney, W. D. Kirkey, M. Furis, and A. N. Cartwright, J. Appl. Phys. **93**, pp. 4933-3935 (2003). (11 citations, impact factor 2.3)
28. **"***Excitonic field screening and bleaching in InGaN/GaN multiple quantum wells***",** F. Chen, W. D. Kirkey, M. Furis, M. C. Cheung, and A. N. Cartwright, Solid State Comm. **125**, pp.617-622 (2003). (5 citations impact factor 1.5)
29. "*Si Doping of High-Al-Mole Fraction $Al_xGa_{1-x}N$ Alloys with RF Plasma-Induced Molecular Beam Epitaxy*", J. Hwang, W. J. Schaff, L. F. Eastman, S. T. Bradley, L. J. Brillson, D. C. Look, J. Wu, W. Walukiewicz, M. Furis, and A. N. Cartwright, Appl. Phys. Lett. **81**, pp.5192-5194 (2002). (21 citations, impact factor 4)
30. "*Interaction of an Electron Gas with Photoexcited Electron-Hole Pairs in ModulationDoped GaAs and CdTe Quantum Wells*", H. A. Nickel, T. Yeo, C. J. Meining, D. R. Yakovlev, M. Furis, A. B. Dzyubenko, B. D. McCombe, and A. Petrou, Physica E **12**, pp.499-502 (2002). (1 citation impact factor 1)
31. "*Quantifying Electrical Spin Injection:Component-Resolved Electroluminescence from Spin- Polarized Light-Emitting Diodes*", B. T. Jonker, A. T. Hanbicki, Y. D. Park, G. Itskos, M. Furis, G. Kioseoglou, and A. Petrou, Appl. Phys. Lett. **79**, pp.3098-3100 (2001). (56 citations, impact factor 4)
32. "*Electrical Spin Injection Across Air-Exposed Epitaxially Regrown Semiconductor Interfaces*", Y. D. Park, B. T. Jonker, B. R. Bennett, G. Itskos, M. Furis, G. Kioseoglou, and A. Petrou, Appl. Phys. Lett. **77**, pp.3989-3991 (2000). (52 citations, impact factor 4)

Peer-Reviewed Conference Proceedings:

1. "*Tunning Exciton Delocalization in Organic Crystalline Thin Films*" K. N. Hua, L. W. Manning, N. Rawat, V. S. Ainsworth, L. Liang, M. Furis, *Proc. SPIE, Light Manipulating Organic Materials and Devices III*. 9939, p. 993907 (2016).
2. *"Organic analogues of diluted magnetic semiconductors: bridging quantum chemistry to condensed matter physics" (invited)* M. Furis, N. Rawat, J.G. Cherian, A. Wetherby, R. Waterman, and S. McGill, *Proc. SPIE, Spintronics VIII*. **9551**: p. 95512I, (2015).

3. *"Tuning exchange interactions in organometallic semiconductors"* N. Rawat, L.W. Manning, K.-N. Hua, R.L. Headrick, J.G. Cherian, M.M. Bishop, S.A. McGill, and M.I. Furis Proc. SPIE, Spintronics VIII. **9551**: p. 95512R, (2015)
4. *"Spin-Polarized PL and Raman Spectroscopy of Nanocrystal Quantum Dots in High Magnetic Fields",* M. Furis, P. D. Robbins, T. Barrick, M. Petruska, V. I. Klimov, and S. A. Crooker, Proceedings of the 27th International Conference on the Physics of Semiconductors A **772,** pp.709-10 (2005).
5. *"Photoluminescence study of MBE grown InGaN with intentional indium segregation",* M. C. Cheung, G. Namkoong, F. Chen, M. Furis, H. E. Pudavar, A. N. Cartwright, W. A. Doolittle, International Workshop on Nitride Semiconductors (IWN 2004), Phys. Stat. Sol. C **7**, pp. 2779-82 (2004). (5 citations)
6. *"Spectroscopy studies of InP nanocrystals synthesized through a fast reaction"* M. Furis, D. J. MacRae, D. W. Lucey, Y. Sahoo, A. N. Cartwright, P. N. Prasad, Mater. Res. Soc. Symposium Proceedings **789**, 89-94 (2004) (2 citations)
7. *"Time-Resolved Photoluminescence of Si-Doped High Al Mole Fraction AlGaN Epilayers*
   Grown by Plasma-Enhanced Molecular Beam Epitaxy", M. Furis, A. N. Cartwright, J. Hwang, and W. J. Schaff, MRS Fall Meeting Conference Proceedings **798**, pp. 667-672, Dec 1st-5th Boston, Massachusetts (2003).
8. *"Emission Mechanisms in UV Emitting GaN/AlN Multiple Quantum Well Structures",* M. Furis, A. N. Cartwright, H. Wu, W. J. Schaff, MRS Fall Meeting Conference Proceedings **798**, pp. 35-40, Dec 1st-5th Boston, Massachusetts (2003).
9. *"Spectroscopy Studies of InP Nanocrystals Synthesized Through a Fast Reaction",* M. Furis, D. J. MacRae, D. W. Lucey, Y. Sahoo, A. N. Cartwright, and P. N. Prasad, MRS Fall Meeting Conference Proceedings **789**, pp. 89-94 Dec 1st-5th Boston, Massachusetts (2003).
10. *"Ultrafast Dynamics in Nanostructured Materials",* A. N. Cartwright, W. D. Kirkey, M. Furis, X. G. Li, Y. Q. He, D. J. MacRae, Y. Sahoo, M. T. Swihart, and P. N. Prasad, Proceedings of the SPIE-The International Society for Optical Engineering **5222**, pp.134139, Nanocrystals and Organic and Hybrid Nanomaterials, Aug 4-8 2003, San Diego, California.
11. "*Room-Temperature Time-Resolved Photoluminescence of UV Emission from GaN/AlN Quantum Wells*", M. Furis, F. Chen, A. N. Cartwright, H. Wu, and W. J. Schaff, MRS Fall Meeting Conference Proceedings **743** pp.689-694, Dec 2nd-6th Boston, Massachusetts (2002).
12. "*Time-Resolved Optical Studies of InGaN Layers Grown on LGO*", M. Cheung, F. Chen, M. Furis, A. N. Cartwright, G. Namkoong, MRS Fall Meeting Conference Proceedings **743** pp.659-664, Dec 2nd-6th Boston, Massachusetts (2002).
13. "*Femtosecond Pump and Probe Spectroscopy of Optical Nonlinearities in an InGaN/GaN Heterostructure*", F. Chen, P. M. Sweeney, W. D. Kirkey, M. Furis, and A. N. Cartwright,
    2002 MRS Fall Meeting Conference Proceedings **L11.8**, Dec 2nd-6th Boston, Massachusetts (2002).
14. "*Molecular Beam Epitaxial Growth of AlN/GaN Multiple Quantum Wells*", H. Wu, W. J.

Schaff, G. Koley, K. A. Mkhoyan, J. Silcox, M. Furis, A. N. Cartwright, W. Henderson, W. A. Doolittle, and A. V. Osinsky, MRS Fall Meeting Conference Proceedings **743** pp.375-80, Dec 2nd-6th Boston, Massachusetts (2002).

15. "*Internal Transitions of Charged Magneto- Excitons in II-VI Quantum Well Heterostructures*", C. J. Meining, M. Furis, H. A. Nickel, D. R. Yakovlev, W. Ossau, A. Petrou, and B. D. McCombe, The 25th International Conference on the Physics of Semiconductors ICPS25 **H086**, Sept. 17th-22nd, Osaka, Japan (2000).

Oral Presentations:

American Physical Society Meetings

1. *"Exploration of exciton delocalization in organic crystalline thin films"* K. –N. Hua, L. Manning, N. Rawat, V. Ainsworth, M. Furis, March 14th–18th, Baltimore, MD (2016)
2. *"Tuning magnetic exchange interactions in crystalline thin films of substituted Cobalt Phthalocyanine"* N. Rawat, L. Manning, K.-N. Hua, R. Headrick, M. Bishop, S. McGill, R. Waterman, M. Furis, March 14th–18th, Baltimore, MD (2016)
3. *"Magnetic Exchange Interactions in Long Range Ordered Diluted Organometallic Semiconductors"*, N. Rawat, L. W. Manning and M. Furis, The 2015 APS March Meeting, March 2nd–6th, San Antonio, Texas (2015)
4. *"Metal/Metal-Free Phthalocyanine Crystalline Alloys: Organic Analogues to Diluted Magnetic Semiconductors"* M. Furis, N. Rawat, L. W. Manning, R. L. Headrick and S. McGill, The 2014 APS March Meeting, March 2014 Denver Colorado
5. *"Exchange Mechanisms in Long Range Ordered Thin Film Organic Magnetic Semiconductors"* N. Rawat, R. L. Headrick, R. Waterman, S. McGill, L. Kilanski, and M. Furis, APS March Meeting, March 2014 Denver Colorado
6. *"Exploration of Excitonic States in Dilute Magnetic Organic Semiconductors"* L. Manning, N. Rawat, C. Lamarche, L. Paladino, I. Cour, R. Headrick and M, Furis, The 2013 APS March Meeting, Baltimore, Maryland (2013)
7. *"Spin exchange interaction in quasi-1D Cu-phthalocyanine crystalline thin film measured by Magnetic Circular Dichroism (MCD) spectroscopy"* Z. Pan, N. Rawat, C. Lamarche, T. Tokumoto, A. Wetherby, R. Waterman, S. McGill, R. L. Headrick, and M. Furis, The 2012 APS March Meeting, Boston, Massachusetts (2012)
8. *"Spatially and Temperature Resolved Photoluminescence (PL) of Excitons in Highly Oriented Phthalocyanine Films"* N. Rawat, Z. Pan, L. Manning, A. Wetherby, R. Waterman, R. Headrick, and M. Furis The 2012 APS March Meeting, Boston, Massachusetts (2012)
9. *"Magneto-optical spectroscopic studies of solid and solution-phase tetra-phenyl porphyrin"* J. Whalen-Strothman, Z. Pan, C. Lamarche, L. Manning, N. Rawat, T. Tokumoto, S. McGill, M. Furis and K. Chu, The 2012 APS March Meeting, Boston Massachusetts (2012)
10. *"Grain Boundary Exploration Of Excitonic States in Organic Crystalline Thin Films"* L. Manning, N. Rawat, Z.Pan, C. Lamarche, I. Cour, R. L. Headrick and M. Furis, The 2012 APS March Meeting, Boston Massachusetts (2012)
11. *"Linear Dichroism and Photoluminescence Microscopy Imaging of Grain Boudanries in Crystalline Metal-Free Phthalocyanine Thin Films"* Z. Pan, C. Lamarche, L. Manning,

N.Rawat, I. Cour, R. L. Headrick and M. Furis, The 2011 APS March Meeting, Dallas TX, (March 2011)

12. *"Polarization-resolved optical spectroscopy imaging of electronic states in crystalline organic semiconductors thin films"*, Z. Pan, I. Cour, M. Sutton, R. Headrick and M. Furis, The 2010 APS March Meeting, Portland Oregon (March 2010)
13. *"Exciton Recombination in Nanometer-Wide GaN/AlN Quantum Wells"*, Z. Pan, M. Furis, W.J. Schaff and A.N. Cartwright, The 2009 APS March Meeting, Pittsburgh Convention Center, Pittsburgh, Pennsylvania (March 2009).
14. *"Bias-Depended Electron Spin Lifetimes in n-type GaAs and the Role of Donor Impact Ionization",* M. Furis, D. L. Smith, S. A. Crooker and J. L. Reno, The 2007 APS March Meeting, Denver Convention Center, Denver, Colorado (March 2007).
15. *"Bright Exciton Fine Structure Observed in Single CdSe Nanocrystal Quantum Dots",* S. A. Crooker, M. Furis, H. Htoon, .M. A. Petruska, V. I. Klimov, The 2006 APS March Meeting ,Baltimore Convention Center, Baltimore, Maryland (March 2006).
16. *"Scanning Kerr Rotation Microscopy of Lateral Spin Transport Devices",* M. Furis, D. L. Smith, S. A. Crooker, X. Lou, C. Adelmann, C. J. Palmstrom, and P. A. Crowell, The 2006 APS March Meeting, Baltimore Convention Center, Baltimore, Maryland (March 2006)
17. *"Mapping Exciton Spin States in CdSe Nanocrystals with Spin-Polarized, Resonant Photoluminescence Spectroscopy"*, M. Furis, T.D. Barrick, S.A. Crooker, M. Petruska, V. I. Klimov, Al. L. Efros, The 2005 APS March Meeting **W15.00012**, March 21st-25th, Los Angeles Convention Center, Los Angeles, California (2005).
18. *"Interband Magneto-Optics in Carbon Nanotubes in Pulsed High Magnetic Fields",* S. Zaric, G. N. Ostojic, J. Kono, O. Portugall, P. Frings, G. Rikken, S. A. Crooker, M. Furis, X. Wei, H. U. Mueller, M. Von Ortenberg, V. C. Moore, J. Shaver, R. H. Hauge, and R. E. Smalley, The 2005 APS March Meeting **B27.00002**, March 21st-25th, Los Angeles Convention Center, Los Angeles, California (2005).
19. "*Recombination Processes in GaAs/AlGaAs Spin Light Emitting Diodes (SpinLEDs*)", M. Furis, G. Itskos, G. Kioseoglou, A. Petrou, Y. D. Park, B. T. Jonker, A. Hanbicki, B. R. Bennett, X. Wei, The 2001 APS March Meeting **J25.009**, March 12-16th, Washington Convention Center, Seattle, Washington (2001).
20. "Efficiency of Electrical Spin Injection in GaAs-based Spin Light Emitting Diodes (SpinLEDs)", G. Itskos, M. Furis, G. Kioseoglou, A. Petrou, Y. D. Park, B. T. Jonker, R. Stroud, A. Hanbicki, and B. R. Bennett, The 2001 APS March Meeting **J25.007**, March 12-16th, Washington Convention Center, Seattle, Washington (2001).
21. "*Effects of Interfacial Microstructure on Spin Injection Efficiency in ZnMnSe/AlGaAsGaAs Spin-LEDs*", R. Stroud, Y. D. Park, A. Hanbicki, B. R. Bennett, B. T. Jonker, M.
    Furis, G. Itskos, G. Kioseoglou, A. Petrou, The 2001 APS March Meeting **J25.008**, March 12-16th, Washington Convention Center, Seattle, Washington (2001).
22. "*Optical, Transport, Structural and Magnetic Properties of Digital Alloys of GaAs/Mn*", X. Chen, M. Furis, G. Itskos, K. P. Mooney, F. Lehmann, G. Kioseoglou, Y. L. Soo, S. Kim, H. Luo, B. D. McCombe, A. Petrou, Y. H. Kao, Y. Sasaki, X. Liu, and J. K. Furdyna, The 2001 APS March Meeting **L25.008**, March 12-16th, Washington Convention Center, Seattle, Washington (2001).

23. "*Internal Transitions of Charged Magneto-Excitons in II-VI Quantum Well Heterostructures*", C. J. Meining, M. Furis, H. A. Nickel, A. Petrou, B. D. McCombe, D. R. Yakovlev, and W. Ossau, The 2001 APS March Meeting **G30.005**, March 12-16th, Washington Convention Center, Seattle, Washington (2001).
24. "*Optically Detected Resonance Spectroscopy of Modulation-Doped GaAs/AlGaAs Multiple Quantum Well Structures*", H. A. Nickel, T. M. Yeo, G. Comanescu, H. D. Cheong, M. Furis, B. D. McCombe, and A. Petrou, The 2000 APS March Meeting **V32.008**, March 20-24th, Minneapolis, Minnesota (2000).
25. "*Magneto-Optical Study of Interface Roughness in type-II AlGaAs/AlAs Quantum Well Structures*", M. Furis, H.D. Cheong, G. Kioseoglou, A. Petrou, M. Dutta, J. Pamulapati, Y. J. Wang, and X. Wei, The 2000 APS March Meeting **V32.006**, March 20-24th, Minneapolis, Minnesota (2000).
26. "*Optically Detected Resonance of an n-Type Edge Doped GaAs/AlGaAs Quantum Well*", H. D. Cheong, T. Yeo, M. Furis, G. Itskos, A. Petrou, B. D. McCombe, and W. J. Schaff, The 2000 APS March Meeting **Y29.014**, March 20-24th, Minneapolis, Minnesota (2000).

Invited Talks

1. *"Exciton Delocalization and Magnetic Interactions in Crystalline Organic Thin Films"* University of Crete, Greece, Materials Science Colloquium, May 2016.
2. *"Exciton Delocalization and Magnetic Interactions in Crystalline Organic Thin Films"* University OF Michigan, Ann Arbor, MI, Condensed Matter Physics Seminar Series, March 2016
3. "*Organic Magnetic Semiconductors: Bridging Quantum Chemistry to Condensed Matter Physics* University of Florida, Physics Dept. Colloquium January 2016
4. *"Exciton Delocalization in Small Molecule Organic Semiconductors"* The 2nd ANGEL (Advanced Next Generation Energy Leadership) Symposium, Nov 2015, Yamagata University, Yonezawa, Japan
5. *"Organic analogues of diluted magnetic semiconductors: bridging quantum chemistry to condensed matter physics" (invited)* M. Furis, N. Rawat, J.G. Cherian, A. Wetherby, R. Waterman, and S. McGill, Spintronics VIII, SPIE, Aug 2015 San Diego CA
6. *"Organic Magnetic Semiconductors: Bridging Quantum Chemistry to Condensed Matter Physics"* Smith College Physics Dept. Colloquium April 2015
7. "*Exploration of Excitonic States in Mixed Organo-Metallic Semiconducting Thin Films"* L. W. Manning, N. Rawat, R. L. Headrick, A. Woll, and M. Furis (Selected Hot Topic presentation) Gordon Research Conference on Conductivity and Magnetism in Molecular Materials: Understanding and Controlling Emergent Properties Aug 3rd-8th , 2014 Bates College, Maine
8. *"Organic Analogues of Diluted Magnetic Semiconductors: Bridging Quantum Chemistry to Condensed Matter Physics"* University of Alabama at Birmingham (UAB) Physics Dept. Colloquium April 2014
9. *"Magneto-Spectroscopy of Organic Crystalline Semiconductors: Bridging Quantum Chemistry to Condensed Matter Physics",* Physics Department Colloquium, Clemson University, September 2013

10. "*Exploring the Origins of Magnetism with Light",* Condensed Matter Seminar, University of Vermont, March 2012
11. *"Optical Spectroscopy in High Magnetic Fields: Bridging Quantum Chemistry to Solid State Physics"* Physics Department Colloquium, University of Vermont, September 2011
12. *"Challenges of Optical Spectroscopy in High Magnetic Fields,* Workshop on Experimental Techniques in High Magnetic Fields, Los Alamos, NM, October 2010
13. "*Polarization –Resolved Spectroscopy Investigation of Molecular Discotic Structures*", Physics Department Seminar, Brown University, April 2010
14. *"Electronic States in Discotic Semiconductors"* Physics Department Seminar, Boston College, April 2010
15. *"Magneto-Optical Microscopy of Spin-Polarized Electrons Dynamics in Semiconductor Nanostructures and Spin-Transport Devices"* Physics Department Seminar, Clark University Nov 2008
16. "*Magneto-Optical Kerr Effect (MOKE) Studies of Spin Drift and Diffusion in n:GaAs Epilayers and Spin-Transport Devices",* Physics Department Seminar, University of Massachusetts at Amherst, May 2008
17. "*Magneto-Optical Kerr Effect (MOKE) Spectroscopy of Spin-Polarized Electron Transport in Semiconductors*", Magnetic Excitations in Semiconductors Conference, March 6^{th}-9^{th} 2008, Buffalo, New York, USA.
18. "*Magneto-Optical Kerr Effect (MOKE) Studies of Spin Drift and Diffusion in n:GaAs Epilayers and Spin-Transport Devices*", Physics and Engineering Joint Department Seminar, McGill University October 2007
19. *"Imaging the Injection, Accumulation and Flow of Spin- Polarized Electrons in Lateral Ferromagnet/Semiconductor Structures"*, M. Furis, MORIS2006 Workshop on Thermal and Optical Magnetic Materials and Devices, Jun 6^{th}-8^{th} 2006, Chiba, Japan.
20. *"Probing the Bright Exciton Fine Structure and Anisotropy Exchange in CdSe Colloidal Nanocrystal Quantum Dots"* Physics Department Seminar Texas A&M, April 2006
21. *"Probing the Bright Exciton Fine Structure and Anisotropy Exchange in CdSe Colloidal Nanocrystal Quantum Dots"*- Physics Department Seminar, University of Vermont March 2006
22. *"Probing the Bright Exciton Fine Structure and Anisotropy Exchange in CdSe Colloidal Nanocrystal Quantum Dots"*- Physics Department Seminar, Ohio University, March 2006
23. *Probing the Bright Exciton Fine Structure and Anisotropy Exchange in CdSe Colloidal Nanocrystal Quantum Dots"*- Physics Department Seminar, Rochester Institute of Technology, February 2006
24. *Probing the Bright Exciton Fine Structure and Anisotropy Exchange in CdSe Colloidal Nanocrystal Quantum Dots*- Physics Department Seminar Georgia State University, February 2006
25. *Probing the Bright Exciton Fine Structure and Anisotropy Exchange in CdSe Colloidal Nanocrystal Quantum Dots"*-Physics Department Seminar Boise University, February 2006
26. *"Probing the Bright Exciton Fine Structure and Anisotropy Exchange in CdSe Colloidal Nanocrystal Quantum Dots"* –School of Optical Sciences Seminar, University of Arizona, Decenber 2005.

27. *"Probing the Bright Exciton Fine Structure and Anisotropy Exchange in CdSe Colloidal Nanocrystal Quantum Dots"*- Physics Department Seminar, University of South Carolina, December 2005
28. *"Probing Exciton Spin States in CdSe Colloidal Nanocrystals: Resonant Photoluminescence Spectroscopy Experiments at B < 33 T",* National High Magnetic Field Laboratory seminar, Florida State University. October 2005
29. *"Exciton Spin States in Nanocrystal Quantum Dots Revealed by Spin-Polarized Resonant Photoluminescence and Raman Spectroscopy"*, M. Furis, T. Barrick, S. A. Crooker, M. Petruska, V. Klimov, and Al. L. Efros, 16th International Conference on High Magnetic Fields in Semiconductor Physics, SEMIMAG16, Aug 2nd-6th 2004, Tallahassee, Florida.
30. *"Photolumiescence Studies of CdSe Colloidal Nanocrystals in High Magnetic Fields",* M. Furis, S. A. Crooker, M. Petruska, J. Hollingsworth, and V. I. Klimov, Physical Phenomena in High Magnetic Fields V, PPHMF-V, Aug. 4th-9th 2005, Tallahassee, Florida

Peer-Reviewed Conferences

1. *"Organic Analogues of Diluted Magnetic Semiconductors: Bridging Quantum Chemistry to Condensed Matter Physics"* Gordon Research Conference on Conductivity & Magnetism in Molecular Materials Aug 14th-19th Mount Holyoke, MA, 2016
2. *"Tuning Exciton Delocalization in Organic Crystalline Thin Films*" K. N. Hua, L. W. Manning, N. Rawat, V. S. Ainsworth, L. Liang, M. Furis, *SPIE, Light Manipulating Organic Materials and Devices III*. Aug 2016, San Diego, CA.
3. *"Magneto-Optical Studies of π-d Exchange in Organic Analogues of Diluted Magnetic Semiconductors"* M. Furis, N. Rawat, K. Hua, L. W. Manning, R Waterman, Conference of Physical Phenomena in High Magnetic Fields PPHMF-8, Jan 2016, Tallahassee, FL.
4. *"Tuning exchange interactions in organometallic semiconductors"* N. Rawat, L.W. Manning, K.-N. Hua, R.L. Headrick, J.G. Cherian, M.M. Bishop, S.A. McGill, and M.I. Furis, Spintronics VIII SPIE, Aug. 2015, San Diego, CA
5. *"Magnetic Exchange Interactions and Long Range Ordering in Metal- Phthalocyanine Organic Semiconductors"* - N. Rawat, L. Manning, R. Waterman, R. L. Headrick, L. Kilanski, S. McGill, and M. Furis Gordon Research Conference on Conductivity and Magnetism in Molecular Materials: Understanding and Controlling Emergent Properties Aug 3rd-8th Bates College, Maine, 2014
6. *"MCD of Crystalline Organic Semiconductors"* N. Rawat, Z. Pan, L. Manning, R. Waterman, S. McGill and M. Furis, The 16th Conference on Modulated Semiconductors Structures, June 30th-July 7th 2013, Worclaw, Poland.
7. *"Imaging Excitons in Crystalline Organic Semiconductors", Z. Pan, C. Lamarche N. Rawat, L. Manning, I.* The 15th Conference on Modulated Semiconductors Structures (MSS-2011) Tallahassee, Florida (2011)
8. *"Bright Exciton Fine Structure Observed in Single CdSe Nanocrystal Quantum Dots",* M. Furis, S. A. Crooker, H. Htoon, M. A. Petruska, and V. I. Klimov, International Conference on the Physics of Semiconductors (ICPS), July 22nd-27th, Viena, AUSTRIA (2006)

9. *"Probing Exciton Spin States in CdSe Nanocrystals Using Resonant Photoluminescence",* M. Furis, T. Barrick, P. D. Robbins, S. A. Crooker, M.Petruska, J, Hollingsworth, and V. I. Klimov, Excited State Processes in Nano- and Bio-Materials, August 8th-11th, Hotel Santa Fe, Santa Fe, New Mexico, USA (2005)
10. *"Photolumiescence Studies of CdSe Colloidal Nanocrystals in High Magnetic Fields",* M. Furis, S. A. Crooker, M. Petruska, J. Hollingsworth, and V. I. Klimov, Physical Phenomena in High Magnetic Fields V, PPHMF-V, Aug. 4th-9th 2005, Tallahassee, Florida.
11. "*Insights into Electrical Spin Injection from Spin-LED Structures*", B. T. Jonker, Y. D. Park, A. Hanbicki, B. R. Bennett, G. Itskos, M. Furis, G. Kioseoglou, and A. Petrou, The 200th Meeting of the Electrochemical Society and the 52nd Annual Meeting of the International Society of Electrochemistry **no.1251**, Sept. 2nd-7th, San Francisco, California (2001).
12. "*Interaction of an Electron Gas with Photoexcited Electron-Hole Pairs in ModulationDoped GaAs and CdTe Quantum Wells*", H. A. Nickel, T. Yeo, C. J. Meining, A. B. Dzyubenko, M. Furis, D. R. Yakovlev, B. D. McCombe, and A. Petrou, The 14th International Conference on the Electronic Properties of Two Dimensional Systems **MB.2**, July 30th-Aug. 3rd, Prague, Czech Republic (2001).
13. "*Growth and Characterization of Digital Alloys of GaAs/MnGa and GaInAs/MnGa*", X. Chen, K. P. Mooney, T. Yeo, M. Furis, L. Guo, H. Luo, B. D. McCombe, A. Petrou, S. Lee, Y. Sasaki, X. Liu, and J. K. Furdyna, The International Conference on the Physics and Applications of Spin-Related Phenomena in Semiconductors PASPS2000 **K2**, Sept. 1315th, Sendai, Japan (2000).
14. "*Transmission Electron Microscopy Studies of ZnMnSe/AlGaAs/GaAs Spin-LEDs*", R. M. Stroud, Y. D. Park, B. T. Jonker, B. R. Bennett, G. Itskos, M. Furis, G. Kioseoglou, and A. Petrou, 2001MRS Spring Meeting **T6.6**, April 16-20th San Francisco, California (2001).
15. "*Efficient Electrical Spin Injection and Realization of Spin-LED*", B. T. Jonker, Y. D. Park, A. Hanbicki, R. M. Stroud, B. R. Bennett, G. Itskos, M. Furis, G. Kioseoglou, and A. Petrou, 2001 MRS Spring Meeting **T6.3**, April 16-20th San Francisco, California (2001).
16. "*Growth and Characterization of Digital Alloys and Heterostructures of GaAs/Mn*", X. Chen, K. P. Mooney, T. Yeo, M. Furis, H. Luo, B. D. McCombe, and A. Petrou, 2000 MRS Fall Meeting **I1.3**, Nov. 27th – Dec. 1st, Boston, Massachusetts (2000).

Poster Presentations:

Material Research Society Meetings (peer-reviewed)

1. *"Exciton Coherence and Superradiance in Organic Crystalline Thin Films"* K. –N. Hua, L. Manning, N. Rawat, L. Liang, V. Ainsworth, M. Arnold; J. Matsui, M. Furis MRS Fall Meeting Conference Nov30th-Dec4th Boston Massachusetts (2016)
2. *"Exploration of Excitonic States in Mixed Organo-Metallic Semiconducting Thin Films"* L. W. Manning, N. Rawat, R. Headrick, R. Waterman, M. Furis, A.Woll MRS Fall Meeting Conference Nov30th-Dec4th Boston Massachusetts (2015)

3. *"Optical Spectroscopy of Electronic States in Crystalline Organic Thin Films"* Z. Pan, I. Cour, C. Lamarche, M. Sutton, R. L. Headrick and M. Furis MRS Fall Meeting Conference Nov^{30th}-Dec^{4th} Boston Massachusetts (2010)
4. *"Interface Effects on the Molecular Alignment of Discotic Phthalocyanine Films"* I. Cour, Z. Pan, L. T. Lebruin, M. Case, M. Furis and R. L. Headrick MRS Fall Meeting Conference Nov^{30th}-Dec^{4th} Boston Massachusetts (2010)
5. "*Effect of Different II-VI Shells on the Photoluminescence of InP Nanoparticles*", M. Furis, W. D. Kirkey, G. Singh, A. N. Cartwright, D. W. Lucey, and P. N. Prasad, MRS Fall Meeting Conference Dec 1st-5th Boston, Massachusetts (2004).
6. *"Time-Resolved Photoluminescence of Si-Doped High Al Mole Fraction AlGaN Epilayers Grown by Plasma-Enhanced Molecular Beam Epitaxy"*, M. Furis, A. N. Cartwright, J. Hwang, and W. J. Schaff, MRS Fall Meeting Conference Dec 1st-5th Boston, Massachusetts (2003).
7. *"Emission Mechanisms in UV Emitting GaN/AlN Multiple Quantum Well Structures",* M. Furis, A. N. Cartwright, H. Wu, W. J. Schaff, MRS Fall Meeting Conference, Dec 1st-5th Boston, Massachusetts (2003).
8. *"Spectroscopy Studies of InP Nanocrystals Synthesized Through a Fast Reaction",* M. Furis, D. J. MacRae, D. W. Lucey, Y. Sahoo, A. N. Cartwright, and P. N. Prasad, MRS Fall Meeting Conference, Dec 1st-5th Boston, Massachusetts (2003).
9. "*Room-Temperature Time-Resolved Photoluminescence of UV Emission from GaN/AlN Quantum Wells*", M. Furis, F. Chen, A. N. Cartwright, H. Wu, and W. J. Schaff, 2002 MRS Fall Meeting Conference Proceedings **L11.14**, Dec 2nd-6th Boston, Massachusetts (2002).
10. "*Time-Resolved Optical Studies of InGaN Layers Grown on LGO*", M. Cheung, F. Chen, M. Furis, A. N. Cartwright, G. Namkoong, W. A. Doolittle, and A. Brown, 2002 MRS Fall Meeting Conference Proceedings **L11.6**, Dec 2nd-6th Boston, Massachusetts (2002).
11. "*Femtosecond Pump and Probe Spectroscopy of Optical Nonlinearities in an InGaN/GaN Heterostructure*", F. Chen, P. M. Sweeney, W. D. Kirkey, M. Furis, and A. N. Cartwright, 2002 MRS Fall Meeting Conference Proceedings **L11.8**, Dec 2nd-6th Boston, Massachusetts (2002).
12. "*Molecular Beam Epitaxial Growth of AlN/GaN Multiple Quantum Wells*", H. Wu, W. J. Schaff, G. Koley, K. A. Mkhoyan, J. Silcox, M. Furis, A. N. Cartwright, W. Henderson, W. A. Doolittle, and A. V. Osinsky, 2002 MRS Fall Meeting Conference Proceedings **L6.2**, Dec 2nd-6th, Boston, Massachusetts (2002).

Other Peer- Reviewed Conferences

1. "*Long - Lived Excitons and Molecular Reorientation in Crystalline Organic Semiconductors*" Z. Pan, L.W. Manning, I. Cour, R. L. Headrick and M. Furis, The 31st International Conference on the Physics of Semiconductors –ICPS2012, July 28th-Aug 3rd, ETH-Zurich, Switzerland (2012)
2. "*Exploring Spin Exchange Mechanisms in Cu-Phthalocyanine Crystalline Thin Films*" Z. Pan, N. Rawat, C. Lamarche, T. Tokumoto, S. McGill and M. Furis, High Magnetic Fields

in Semiconductor Physics Conference, HMF-20, July 22nd-26th , Chamonix, France (2012).

3. *"Relationship Between Molecular Alignment, Ordering and Charge Carrier Transport Properties of Discotic Phthalocyanines"* I. Cour, Z. Pan, L. T. Lebruin, M. Case, M. Furis, R. L. Headrick, Gordon Research Conference on Organic Electronics, July 22nd-28th 2010, Mount Holyoke College, Hadley, Massachusetts
4. *"Electronic States in Discotic Crystalline Phthalocyanine Thin Films",* Z. Pan, I Cour, M. Sutton, R. Headrick and M. Furis, Gordon Research Conference on Organic Electronics, July 22nd-28th 2010, Mount Holyoke College, Hadley, Massachusetts.
5. "*Magneto-Optical Kerr Effect (MOKE) Spectroscopy at the University of Vermont*" Z. Pan, L.Zhou, H.Zhou, R Headrick, H. Zeng and M. Furis, Magnetic Excitations in Semiconductors", March 6th-9th, 2008 Buffalo, New York
6. "Exciton *Dynamics in Nanometer-Wide GaN/AlN Quantum Wells and Si:AlGaN Epilayers",* M Furis, A. N. Cartwright and W. J. Schaff, Multifunctional Nanomaterials and Nanodevices, May18th-19th, 2007 Buffalo, New York
7. "*Imaging Spin Injection and Spin Accumulation in Lateral Ferromagnet/Semiconductor Devices*", S. A. Crooker, M. Furis, X. Lou, C. Adelmann, D. L. Smith, C. J. Palmstrom, P. A. Crowell, Physical Phenomena in High Magnetic Fields V, PPHMF-V, Aug. 4th-9th 2005, Tallahassee, Florida
8. "*Optical and Transport Studies of GaAs Doped with Mn and GaAs/Mn Digital Alloys*", M. Furis, G. Comanescu, M. H. Na, A. Petrou, B. D. McCombe, H. Luo, Y. Sasaki, X. Liu, and J. K. Furdyna, The 1st International Conference and School on Spintronics and Quantum Information Technology SpinTech-I **no. 018,** May 13-18th, Maui, Hawaii (2001).

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EDUCATION

PhD,	Materials Science and Engineering, University of Pennsylvania, 1988
BS,	Physics, Carnegie-Mellon University, 1982.

EMPLOYMENT AND RESEARCH EXPERIENCE

2001-present	Department of Physics, The University of Vermont, Burlington, VT. Professor (2012 – present) Interim Department Chair (01/2017 – present) Director of the Materials Science Program: (09/2006 – 08/2013) Associate Professor (2005 – 2012) Assistant Professor (2001 – 2005) Research interests in the dynamics of sputter deposition, molecular beam epitaxy, and pulsed laser deposition; growth and characterization of organic semiconductor thin films.
1991-2001	Cornell University, Ithaca, N.Y., Senior Staff Scientist, Cornell High Energy Synchrotron Source. Developed in-situ growth and surface processing capabilities on the 24-pole wiggler station, A2.
1989-1991	AT&T Bell Laboratories, Murray Hill, NJ. Postdoctoral Member of Technical Staff, with Dr. Leonard Feldman. Studied ordered delta-doping of silicon, using x-ray scattering to probe ordered buried layers in silicon.
1982-1988	University of Pennsylvania, Philadelphia, PA. Graduate Research Associate Department of Materials Science and Engineering, with Professor William R. Graham. PhD Thesis title: "Geometric structure of adsorbate covered surfaces determined by medium energy ion scattering".

HONORS AND AWARDS

Outstanding reviewer award from the Editors and staff of the Review of Scientific Instruments and The American Institute of Physics, 2011
Nominated for the Kroepsch-Maurice Excellence in Teaching Award, 2005.
NSF CAREER grant, 2004.
IBM Corporation Graduate Fellowship, 1985, 1986
University of Pennsylvania Graduate Fellowship, 1982

RESEARCH FUNDING (SINCE 2002)

8/1/2015–7/31/2018	National Science Foundation, Division of Materials Research, Ceramics Program "Real-time X-ray Scattering Studies of Oxide Epitaxial Growth." (NSF-DMR-1506930)	$480,000

7/1/2013–6/30/2016	National Science Foundation, Division of Materials Research, Electronic and Photonic Materials Program "Real-time Studies of Solution Processed Organic Semiconductor Thin Films." (NSF-DMR-1307017)	$371,921
6/1/2011–5/31/2015	U.S. Department of Energy, Basic Energy Sciences, Materials Sciences and Engineering Division. "Fundamental mechanisms of roughening and smoothing during thin film deposition" (Continuation of DE-FG02-07ER46380)	$550,729
3/1/2010 – 2/29/2013	National Science Foundation, Major Research Instrumentation Program. "MRI-R2 Consortium: Development of a system for real-time x-ray analysis of complex oxide thin film growth" (NSF-DMR- 0959486)	$287,204
10/1/2010–9/30/2011	National Science Foundation, Division of Chemistry "MRI: Acquisition of an X-ray Diffractometer at the University of Vermont" (NSF-CHE- 1039436) co-PI with R. Waterman, U. of Vermont	$221,193
9/1/2008 – 8/31/2010	National Science Foundation, Division of Materials Research "MRI: Acquisition of Magneto-Optical Microscopy Instrumentation for Research and Education" (NSF-DMR- 0821268) co-PI with M. Furis, U. of Vermont	$242,539
6/10/2009–5/31/2011	U.S. Department of Energy, Basic Energy Sciences, Materials Sciences and Engineering Division. "Fundamental mechanisms of roughening and smoothing during thin film deposition" (USDOE DE-FG02-07ER46380)	$134,922
3/1/2007 – 2/28/2009	National Science Foundation, Division of Materials Research "MRI: Development of a system for thin film deposition of highly ordered organic materials" (NSF-DMR- 0722451)	$188,520
6/1/2007 – 5/31/2011	U.S. Department of Energy, Basic Energy Sciences, Materials Sciences and Engineering Division. "Fundamental mechanisms of roughening and smoothing during thin film deposition" (USDOE DE-FG02-07ER46380)	$479,003
3/1/2004 – 2/30/2010	National Science Foundation, Division of Materials Research "CAREER: X-Ray Diffraction Studies of Semiconductor and Metal Thin Film Growth" (NSF-DMR-0348354)	$606,864

10/1/2003–9/30/2007	U.S. Department of Energy, Basic Energy Sciences, Materials Sciences and Engineering Division "Fundamental Mechanisms of Interface Roughness" (DE-FG02-03ER46032)	$402,239
9/1/2002 – 8/31/2005	National Science Foundation, Division of Materials Research "Development of a system for time-resolved studies of film growth and processing and student training" (DMR-0216704)	$139,966

INSTRUCTIONAL FUNDING

6/1/2011-5/31/2012	University of Vermont Clean Energy Fund. "Polymer Solar Cell Teaching Lab Project"	$15,050.
1/1/2014-6/30/2014	NISE Network Mini Grant. "Polarization as a Tool and Associated Natural Phenomena"	$3,000.

TEACHING

2001 – 2015 University of Vermont

Introductory Courses and Seminars:

Freshman Seminar: Nanoscience and Nanotechnology (Physics 095)—Fall 2005, Fall 2008, Fall 2009
Introductory Physics I, Non-calculus (Physics 011)—Fall 2006
Electromagnetism and Modern Physics (Physics 042)—Spring 2004, Spring 2005, Spring 2006
Physics for Engineers I (Physics 031) —Fall 2014
Physics for Engineers II (Physics 125) —Fall 2016

Intermediate Courses:

Waves and Quanta (Physics 128)—Fall 2010, Fall 2011, Fall 2012, Fall 2013
Modern Physics Lab (Physics 130)—Fall 2010, Fall 2011, Fall 2012, Fall 2013
Introduction to Materials Science (Physics 195)—Spring 2010
Nanophysics (Physics 196)—Spring 2007, Spring 2009

Advanced Undergraduate Courses:

Junior/Senior Laboratory (Physics 202)—Spring 2012, Spring 2013, Spring 2014, Spring 2015, Spring 2016
Electricity and Magnetism (Physics 213)—Spring 2002, Spring 2003
Classical Electrodynamics (Physics 214)—Fall 2001, Fall 2002, Fall 2003, Fall 2004
Thermal Physics (Physics 265)—Spring 2007, Spring 2009, Spring 2011

Graduate Courses:

Teaching College Physics (Physics 305)—Spring 2013, Spring 2014, Spring 2015, Spring 2016

THESES SUPERVISED

Undergraduate Students

Jonathan Bessette, Physics, B.S. 2005, honors thesis: "Organic Field Effect Transistors," which was completed during the 2004-2005 academic year. Mr. Bessette was co-author on one refereed journal publication.

Graduate Students

Current students:

Jeffrey Ulbrandt, PhD. candidate in Materials Science. Period of supervision: Fall 2012 – present.
Jing Wan, PhD. candidate in Materials Science. Period of supervision: Fall 2013 – present.
Yang Li, PhD. candidate in Materials Science. Period of supervision: Fall 2013 – present.

Former students:

Ishviene Cour, Ph. D. in Materials Science. Period of supervision: Fall 2007 – Spring 2012. Dissertation title: "Molecular alignment and stress in organic thin films." Current Position: Process Engineer, Intel Corp.

Hua Zhou, Ph. D in Materials Science, October 2007. Period of supervision: Fall 2002 - Spring 2007. Dissertation title: "Ion beam erosion-induced self-organized nanostructures on sapphire." Current position: Assistant Scientist, Advanced Photon Source, Argonne National Laboratory.

Lan Zhou, Ph. D. in Materials Science, January 2011. Period of supervision: Fall 2003 - Fall 2010. Dissertation title: "Formation of nanoscale clusters and islands in thin film deposition processes and their effects on surface roughness and stress." Current position: Postdoctoral Research Associate, Department of Materials Science, Research Scientist at JCAP Energy Innovation Hub, California Institute of Technology, California Institute of Technology.

Songtao Wo, Ph. D. in Materials Science, May 2011. Period of supervision: Fall 2004 - Spring 2011. Dissertation title: "Study of grain structure and interfacial structure in organic semiconductor thin films." Current Position: Device Engineer, Samsung Corp.

POSTDOCTORAL SCHOLARS SUPERVISED

Yiping Wang, Period of supervision: October 2004 – March 2006 and November 2007 – May 2009. Current position: Professor, Beijing University of Aeronautics and Astronautics (China)

Zangcheng Xu, Current position: Period of supervision: April 2004 – September 2004. Professor, Nankai Univerisity (China)

Almamun Ashrafi, Period of supervision: March 2010 – June 2011. Current position: Research Fellow, Department of Materials Engineering, Monash University (Australia).

Priya Chinta, Period of supervision: March 2010 – December 2012.

Som Dahal, Period of Supervision: August 2013 – January 2014. Current position: Senior Research Scientist, Natcore Technology Inc.

SELECTED COMMITTEES

Departmental:

Graduate studies (2010 - 2013)
Faculty Evaluation for 1 Junior Faculty Member (2012 - 2016)
Faculty Search (Chair, 2013 - 2015)
Colloquium (2012 – 2015)
STEM building committee (2013 – 2015)

University/College*:*

Faculty Senate, Senator representing the Department of Physics (2011 – 2012, Spring 2016)
Faculty Senate, Financial and Physical Planning Committee (a standing committee, 2012 - 2015)
College of Arts & Sciences, Academic Planning and Budget Committee (2013 – 2016)
Faculty Representative to the Board of Trustees, Budget Finance and Investment Committee (2014 – 2015)
Materials Science Program Steering Committee (2004 – 2013, Chair 2006 - 2013)

External:

National Synchrotron Light Source II, Spokesperson for Participating User Group on Facility for In-situ X-ray Scattering Studies of Thin Film Growth and Processing, Beamline 4-ID, (2015 – present).
National Synchrotron Light Source II, Beamline Advisory Team, In-Situ & Resonant Scattering, (2012 - 2016).
NSF Major Research Instrumentation proposal review panel (2015).
NSF Electronic and Photonic Materials proposal review panel (2014, 2015).
National Synchrotron Light Source, Soft Condensed Matter Panel for synchrotron general user proposals (2010).
National Synchrotron Light Source, Contributing User Group, X21 beamline (2006 – 2014).

REFEREED PUBLICATIONS

1. J.G. Ulbrandt, M.G. Rainville, C. Wagenbach, S. Narayanan, A.R. Sandy, H. Zhou, K.F. Ludwig Jr, R.L. Headrick, "Direct measurement of the propagation velocity of defects using coherent X-rays", *Nature Physics* **12** (8), 794 (2016)
2. L.W. Manning, N. Rawat, C. Lamarche, R. Waterman, R.L Headrick, M. Furis, "Exciton Delocalization in H2OBPc1–x MOBPc x (M= Co, Cu, Ni, Mn) Crystalline Thin-Film Organic Alloys", *J. Phys. Chem. C* **120** (22), 11966 (2016).
3. Y. Li, J. Wan, D.M. Smilgies, N. Bouffard, R. Sun, and R.L. Headrick, "Nucleation and strain-stabilization during organic semiconductor thin film deposition", *Sci. Rep.* **6** 32620 (2016).
4. J. Wan, Y. Li, J.G. Ulbrandt, D.-M. Smilgies, J. Hollin, A.C. Whalley, and R.L. Headrick, "Transient phases during fast crystallization of organic thin films from solution," *APL Mater*. **4**, 016103 (2016)
5. M.G. Rainville, C. Wagenbach, J.G. Ulbrandt, S. Narayanan, A.R. Sandy, H. Zhou, R.L. Headrick, and K.F. Ludwig, Jr., "Co-GISAXS technique for investigating surface growth dynamics," *Phys. Rev. B* **92**, 214102 (2015)
6. B. Bein, H.-C. Hsing, S.J. Callori, J. Sinsheimer, P.V. Chinta, R.L. Headrick and M. Dawber, "In situ X-ray diffraction and the evolution of polarization during the growth of ferroelectric superlattices," *Nat. Commun.* **6** 10136 (2015)
7. Z. Pan, N. Rawat, I. Cour, L. Manning, R. L. Headrick and M. Furis, "Polarization-resolved spectroscopy imaging of grain boundaries and optical excitations in crystalline organic thin films," *Nat. Commun*. **6**, 8201 (2015)
8. N. Rawat, Z. Pan, L.W. Manning, C.J. Lamarche, I. Cour, R.L. Headrick, R. Waterman, A.R. Woll, and M. I. Furis, "Macroscopic Molecular Ordering and Exciton Delocalization in Crystalline Phthalocyanine Thin Films," *J. Phys. Chem. Lett.* 6 (10), 1834 (2015).

9. N. Rawat, Z. Pan, C.J. Lamarche A. Wetherby, R. Waterman, T. Tokumoto, J.G. Cherian, R.L. Headrick, S.A. McGill, and M.I. Furis, "Spin Exchange Interaction in Substituted Copper Phthalocyanine Crystalline Thin Films'" *Sci. Rep.* 5, 16536 (2015).
10. P.V. Chinta and R. L. Headrick. Bimodal island size distribution in heteroepitaxial growth. *Phys. Rev. Lett*. **112** 075503 (2013).
11. S. Biswas, N. Geva, M. Shtein, Y. Yang, R. Clarke, M. Schlepütz, R.L. Headrick, R. Pindak. Mapping of morphology and electronic properties of air-printed pentacene films. *Adv. Func. Mater.* **24** 3907 (2014)
12. J. Sinsheimer, S.J. Callori, B. Ziegler, B. Bein, P.V. Chinta, A. Ashrafi, R.L. Headrick, and M. Dawber. In-situ x-ray diffraction study of the growth of highly strained epitaxial $BaTiO_3$ thin films. *Appl. Phys. Lett.* **103** 242904 (2013)
13. I. Cour, P.V. Chinta, C.M. Schlepütz, Y. Yang, R. Clarke, R. Pindak, and R.L. Headrick. Origin of stress and enhanced carrier transport in solution-cast organic semiconductor films. *J. Appl. Phys.* **114**, 093501 (2013)
14. P.V. Chinta, S.J. Callori, M. Dawber, A. Ashrafi, and R.L. Headrick. Transition from laminar to three-dimensional growth mode in pulsed laser deposited $BiFeO_3$ film on (001) $SrTiO_3$. *Appl. Phys. Lett.* **101**, 201602 (2012)
15. "Transition from laminar to three-dimensional growth mode in pulsed laser deposited $BiFeO_3$ film on (001) $SrTiO_3$," P.V. Chinta, S.J. Callori, M. Dawber, A. Ashrafi, and R.L. Headrick, *Appl. Phys. Lett.* **101**, 201602 (2012).
16. "Fabrication and Characterization of Controllable Grain Boundary Arrays in Solution Processed Small Molecule Organic Semiconductor Films", S. Wo, R.L. Headrick, and J.E. Anthony, *J. Appl. Phys.* **111**, 073716 (2012).
17. "Selective orientation of discotic films by interface nucleation", I. Cour, Z. Pan, L.T. Lebruin, M.A. Case, M. Furis, and R.L. Headrick, *Organic Electronics*. **13**, 419 (2012)
18. "Lattice relaxation of dimer islands on Ge(001) during homoepitaxy by pulsed laser deposition," L. Zhou, Y.P. Wang, M. Li, and R.L. Headrick, *Physical Review B*, **84**, 165301 (2011).
19. "Pressure-dependent transition from atoms to nanoparticles in magnetron sputtering: Effect on WSi_2 film roughness and stress," L. Zhou, Y.P. Wang, H. Zhou, M.H. Li, R.L. Headrick, K. MacArthur, B. Shi, R. Conley, and A.T. Macrander, *Physical Review B*, **82**, 075408 (2010).
20. "Working Model of an Atomic Force Microscope," K. Bonson, R.L. Headrick, D. Hammond, and M. Hamblin, *American Journal of Physics*, **79**, 189 (2011).
21. "Ripple formation and smoothening on insulating surfaces," R.L. Headrick and H. Zhou, Invited review article for *Journal of Physics: Condensed Matter*. **21**, 24005 (2009). Special issue on "Surface nanopatterns induced by ion beam sputtering."
22. "Mechanism of pattern formation and smoothing of oxide surfaces induced by ion beam erosion", H. Zhou, L. Zhou, G Ozaydin, K.F. Ludwig, and R .L. Headrick, *Phys. Rev. B* **78**, 165404 (2007)
23. "Anisotropic mobility in large grain size solution processed organic semiconductor thin films," R.L. Headrick, S. Wo, F. Sansoz, and J.E. Anthony, *Appl. Phys. Lett.* **92**, 063302, (2008).
24. "Real-time X-ray studies of the growth of Mo-seeded Si nanodots by low-energy ion bombardment," G. Ozaydin, Y. Wang, K.F. Ludwig Jr., H. Zhou, and R.L. Headrick, *Nuclear Inst. and Methods in Physics Research, B*, **264**, 47 (2007).
25. "Wavelength tunability of ion-bombardment induced ripples on sapphire," H. Zhou, Y.-P. Wang, L. Zhou, R.L. Headrick, A.S. Ozcan, Y.-Y. Wang, G. Ozaydin, and K.F. Ludwig, Jr., *Physical Review B*, **75**, 155416 (2007).
26. "Interface roughness evolution in sputtered WSi_2/Si multilayers," Y.P. Wang, H. Zhou, L. Zhou, R.L. Headrick, A.T. Macrander, and A.S. Ozcan, *J. Appl. Phys.* **101**, 023503 (Jan 2007).
27. "Self-assembled and etched cones on laser ablated polymer surfaces," N.S. Murthy, R.D. Prabhu, J.J. Martin, L. Zhou, and R.L. Headrick, *J. Appl. Phys.* **100**, 023538 (2006).
28. "Structure of a pentacene monolayer deposited on SiO_2: Role of trapped interfacial water," S.T. Wo, B.R. Wang, H. Zhou, Y.P. Wang, J. Bessette, R.L. Headrick, A.C. Mayer, G.G. Malliaras, and A. Kazimirov, *J. Appl. Phys.* **100**, 093504 (2006).
29. "Growth dynamics of pentacene thin films," A.C. Mayer, R. Ruiz, H. Zhou, R.L. Headrick, A. Kazimirov, and G.G. Malliaras, *Physical Review B* **73**, 205307 (2006).
30. "Real-time x-ray studies of Mo-seeded Si nanodot formation during ion bombardment," G. Ozaydin, A.S. Ozcan, Yiyi Wang, K.F. Ludwig, Hua Zhou, R.L. Headrick, and D.P. Siddons, *Applied Physics Letters* **87**, 163104 (2005).
31. "Pentacene thin film growth", R. Ruiz, D. Choudhary, B. Nickel, T. Toccoli, K.-C. Chang, A.C. Mayer, P. Clancey, R.L. Headrick, S. Iannotta, and G.G. Malliaras, *Chemistry of Materials* **16**, 4497 (2004).
32. "Structure of pentacene thin films", R. Ruiz, G.G. Malliaras, B. Nickel, G. Scoles, A.K. Kazimirov, H. Kim, R.L. Headrick, and Z. Islam, Applied Physics Letters **85**, 4926 (2004).

33. "Early stages of pentacene film growth on silicon oxide", A. Mayer, R. Ruiz, R.L. Headrick, A. Kazimirov, and G.G. Malliaras, Organic Electronics **5**, 257 (2004).
34. "Si(100) surface morphology evolution during normal-incidence sputtering with 100-500 eV Ar^+ ions", K.F. Ludwig, C.R. Eddy, O. Malis, R.L. Headrick, Appl. Phys. Lett., **81**, 2770, (2002).
35. "Multilayer optics for a wiggler beamline", R.L. Headrick, K.W. Smolenski, A. Kazimirov, C. Liu, and A.T. Macrander, Rev. Sci. Instrum. **73**, 1476 (2002).
36. "Spontaneous Nanoscale corrugation of SiO_2: The role of ion-irradiation enhanced viscous flow", C.C. Umbach, R.L. Headrick, and K.-C. Chang, Phys. Rev. Lett. **87**, 246104 (2002).
37. "Ion-induced pattern formation on Co surfaces: an x-ray scattering and Kinetic Monte Carlo study", O. Malis, J.D. Brock, R. L. Headrick, Min-Su Yi, and J.M. Pomeroy, Phys Rev. B **66**, art. no. 035408 (2002).
38. "Orientation of pentacene films using surface alignment layers and its influence on thin film transistor characteristics", M.L. Swiggers, G. Xia, J.D. Slinker, A.A. Gorodetsky, G.G. Malliaras, R.L. Headrick, C. Dulcey and R.N. Shashidhar, Applied Physics Letters, **79**, 1300 (2001).
39. "Roughness in sputtered multilayers analyzed by transmission electron microscopy and X-ray diffuse scattering", A.T. Macrander, C. Liu, R. Csencsits, R. Cook, M. Kirk, and R. Headrick, Physica B **283**, 157 (2000).
40. "Persistent layer-by-layer sputtering of Au(111)", M.V.R. Murty, A.J. Couture, B.H. Cooper, A.R. Woll, J.D. Brock, and R.L. Headrick, Journal of Applied Physics **88**, 597 (2000).
41. "Revisiting the ripple phase using fully hydrated, aligned DPPC multibilayers", J. Katsaras S. Tristram- Nagle, Y. Liu, R.L. Headrick, E. Fontes, P.C. Mason, J.F. Nagle, Biophysical Journal **78**, 116 (2000).
42. "Clarification of the ripple phase of lecithin bilayers using fully hydrated, aligned samples", J. Katsaras, S. Tristram-Nagle, Y. Liu, R.L. Headrick, E. Fontes, P.C. Mason, J.F. Nagle, Physical Review E **61**, 5668 (2000).
43. "Real-time x-ray scattering study of surface morphology evolution during ion erosion and epitaxial growth of Au(111)", M.V.R. Murty, T. Curcic, A. Judy, B.H. Cooper, A.R. Woll, J.D. Brock, S. Kycia, and R.L. Headrick, Physical Review B **60**, 16956 (1999).
44. "The effect of crystalline domain size on the photophysical properties of thin organic molecular films", A.J. Mäkinen, A.R. Melnyk, S. Schoemann, R.L. Headrick, Y. Gao, Physical Review B **60**, 14683 (1999).
45. "Nucleation and growth of GaN on sapphire (0001): incorporation and interlayer transport", A.R. Woll, R.L. Headrick, S. Kycia, and J.D. Brock, Physical Review Letters **83**, 4349 (1999).
46. "Ion-assisted nucleation and growth of GaN on Sapphire(0001)", R.L. Headrick, S. Kycia, A.R. Woll, J.D. Brock, M.V. Ramana Murty, Phys. Rev. B **58**, 4818 (1998).
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48. "Real-time x-ray-scattering measurement of the nucleation kinetics of cubic gallium nitride on β-SiC(001)", R.L. Headrick, S. Kycia, Y.K. Park, A.R. Woll, and J.D. Brock, Phys. Rev. B **54**, 14686 (1996).
49. "Small-angle x-ray scattering from lipid bilayers is well described by modified Caille theory but not by paracrystalline theory", R. Zhang, S. Tristram-Nagle, W. Sun, R.L. Headrick, T.C. Irving, R.M. Suter, and J.F. Nagle, Biophys. J. **70**, 349 (1996).
50. "Electron microscopy of the ordered boron 2×1 structure buried in crystalline silicon", B.E. Weir, D.J. Eaglesham, L.C. Feldman, H.S. Luftman and R.L. Headrick, Applied Surface Science, **84**, 413 (1995).
51. "Critical Fluctuations in Membranes", Ruitian Zhang, Wenjun Sun, Stephanie Tristram-Nagle, R.L. Headrick, Robert M. Suter and John F. Nagle, Phys. Rev. Lett. **74**, 2832 (1995).
52. "Anisotropic Roughness in $Si_{1-x}Ge_x$/Si Superlattices", R.L. Headrick, J.-M. Baribeau, and Y.E. Strausser, Appl. Phys. Lett., **66**, 96, (1995).
53. "Nature and Evolution of Interfaces in Si/$Si_{1-x}Ge_x$ Superlattices", J.-M. Baribeau and R.L. Headrick, Journal of Electronic Materials, **24**, 341 (1995).
54. "Roughness in $Si_{1-x}Ge_x$/Si Superlattices: Growth Temperature Dependence", R.L. Headrick and J.-M. Baribeau, J. Vac. Sci. Technol. A **13**, 782 (1995).
55. "Redesigned front end for the upgrade at CHESS", R.L. Headrick and K.W. Smolenski, Rev. Sci. Instrum. **67**, 1 (1995).
56. "Electrical characterization of an ultrahigh concentration boron delta-doping layer", B.E. Weir, L.C. Feldman, D. Monroe, H.-J. Gossmann, R.L. Headrick, T.R. Hart, Applied Physics Letters, **65**, (6), 737 (1994).
57. "Interfacial Studies in Semicondutor Heterostructures by X-Ray Diffraction Techniques", J.-M. Baribeau, R.L. Headrick and P. Maigné, Scanning Microscopy, **8**, 751 (1994).
58. "Correlated Roughness in $(Ge_mSi_n)_p$ Superlattices", R.L. Headrick and J.-M. Baribeau, Phys. Rev. B, **48**, 9174 (1993).

59. "Interface Roughness in Ge/Si Superlattices", R.L. Headrick and J.-M. Baribeau, J. Vac. Sci. and Technol. B, **11**, 1514 (1993).
60. "Influence of Annealing on the Interface Structure and Strain Relief in Si/Ge Heterostructures", D.J. Lockwood, J.-M. Baribeau, T.E. Jackman, P. Aebi, T. Tyliszczak, A.P. Hitchcock, and R.L. Headrick, Scanning Microscopy, **7**, 457 (1993).
61. "X-ray and Raman Scattering Characterization of Ge/Si Buried Layers", R.L. Headrick, J.-M. Baribeau, D.J. Lockwood, T.E. Jackman, and M.J. Bedzyk, Appl. Phys. Lett. **62**, 687 (1993).
62. "Boron-Silicon Alloy Delta Layer" , B.E Weir, R.L. Headrick, Q. Shen, L.C. Feldman, M. Needels, M.S. Hybertsen, M. Schlüter, and T.R. Hart, Phys. Rev. B **46**, 12861 (1992).
63. "High-flux x-ray undulator radiation from proposed B factory storage rings at Cornell University", D.H. Bilderback, B.W. Batterman, M.J. Bedzyk, J. Brock, K. Finkelstein, R. Headrick, and Q. Shen, Rev. Sci. Instrum. **63** (1), 1590 (1992).
64. "Buried, ordered structures: boron in Si(111) and Si(100)", R.L. Headrick, B.E. Weir, A.F.J. Levi, D.J. Eaglesham, and L.C. Feldman, Journal of Crystal Growth **111**, 838 (1992).
65. "Ordered Monolayer Structures of boron in Si(111) and Si(100)", R.L. Headrick, B.E. Weir, A.F.J. Levi, B. Freer, J. Bevk, and L.C. Feldman, J. Vac. Sci. and Technol., A **9** (4), 2269 (1991).
66. "Mechanically and Thermally Stable Si-Ge Films and Heterojunction Bipolar Transistors Grown by RapidThermal Chemical Vapor Deposition (RTCVD) at 900°C", M.L. Green, B.E. Weir, D. Brasen, Y.F. Hseih, G. Higashi, A. Feygenson, L.C. Feldman, and R.L. Headrick, J. Appl. Phys. **69** (2), 745 (1991).
67. "Low Temperature Homoepitaxy on Si(111)", B.E. Weir, R.L. Headrick, J. Bevk, B.S. Freer, and L.C. Feldman, Appl. Phys. Lett., **59**, (2), 204 (1991).
68. "Electrical Conduction in the Si(111):B-($\sqrt{3}\times\sqrt{3}$)R30° Interface Reconstruction", R.L. Headrick, A.F.J. Levi, H.S. Luftman, J. Kovalchick, and L.C. Feldman, Phys. Rev. B, **43**, 14711, (1991).
69. "Energy Dependent Vibrational Spectra of the Si(111)-B Surface", J.E. Rowe, R.A. Malic, E.E. Chaban, R.L. Headrick, and L.C. Feldman, Journal of Electron Spectroscopy and Related Phenomena, **54**, 1115 (1990).
70. "The Si(100)-(2x1) Boron Reconstruction: Self-Limiting Monolayer Doping", R.L. Headrick, B.E. Weir, A.F.J. Levi, D.J. Eaglesham, and L.C. Feldman, Appl. Phys. Lett. **57**, 2779 (1990).
71. "Surface States and Alkalai-to -Semiconductor Charge Transfer of the K/Si(111) ($\sqrt{3}\times\sqrt{3}$) R30°-B System", Y. Ma, J.E. Rowe, E.E. Chaban, C.T. Chen, R.L. Headrick, G.M. Meigs, S. Modesti, and F. Sette, Phys. Rev. Lett., 65, 2173 (1990).
72. "Secondary Ion Mass Spectroscopy on delta-doped GaAs grown by Molecular Beam Epitaxy", E.F. Shubert, H.S. H.S. Luftman, R.F. Kopf, R.L. Headrick, and J.M. Kuo, Appl. Phys. Lett., **57**, 1799 (1990).
73. "Influence of Surface Reconstruction on the Orientation of Homoepitaxial Silicon Films", R.L. Headrick, B.E. Weir, J. Bevk, B.S. Freer, and L.C. Feldman, Phys. Rev. Lett., **65**, 1128, (1990).
74. "Structure Determination of the Si(111):B ($\sqrt{3}\times\sqrt{3}$) Surface: Subsurface Substitutional Doping", R.L. Headrick, I.K. Robinson, E. Vlieg, and L.C. Feldman, Phys. Rev. Lett., **63**, 1253 (1989).
75. "Stability of Boron- and Gallium- Induced Surface Structures on Si(111) During Deposition and Epitaxial Growth of Silicon", R.L. Headrick, L.C. Feldman, and I.K. Robinson, Appl. Phys. Lett., **55**, 442 (1989).
76. "Medium-energy Ion Scattering Study of the Initial Stage of Oxidation of Fe(001)", R.L. Headrick, P. Konarski, S.M. Yalisove, and W.R. Graham, Phys. Rev B **39**, 9 (1989).
77. "Geometric Structure of the Si(111):As-1x1 Surface", R.L. Headrick and W.R. Graham, Phys. Rev. B **37**, 1051 (1988).
78. "Medium-energy ion scattering study of the Si(111):As-1×1 surface", R.L. Headrick and W.R. Graham, J. Vac. Sci. Technol. A, **6** (3), 637 (1988).
79. "A UHV-Compatible DE-E Gas Telescope for Depth Profiling and Surface Analysis of Light Elements", A.M. Behrooz, R.L. Headrick, L.E. Seiberling, and R.W. Zurmuhle, Nucl. Instrum. Meth. B **28**, 108 (1987).
80. "MeV Ion Induced Modification of the Native Oxide of Silicon", R.L. Headrick and L.E. Seiberling, Mat. Res. Soc. Symp. Proc. **51**, 363 (1986).
81. "Non-Registered Silicon Produced at Metal-Silicon Interfaces by 14 MeV Oxygen Ions", R.L. Headrick and L.E. Seiberling, Appl. Phys. Lett. **45**, 288 (1984).

BOOK CHAPTERS

1. "Ordered Delta Doping", R.L. Headrick, B.E. Weir, and L.C. Feldman, in Delta Doping of Semiconductors, E.F. Schubert, ed. (Cambridge University Press, 1996.)

PATENTS

1. "Process for fabricating a thin crystalline structure", United States Patent US 7,351,283 B2, Randall L. Headrick, April 2008.
2. "Methods for forming one or more crystalline layers on a substrate," R.L. Headrick, United States Patent 9444049, (2016).

SELECTED INVITED TALKS (SINCE 2010)

1. "In-situ x-ray scattering studies of organic semiconductor thin film deposition", R.L. Headrick, Cornell High Energy Synchrotron Source Users Meeting, Cornell University, June 7, 2016.
2. "In-situ x-ray scattering studies of organic semiconductor thin film deposition", R.L. Headrick, CHESS-U Workshop on Materials Design and Processing from Nano to Mesoscale, Cornell University, June 13, 2016.
3. "X-ray Diffraction Scattering at a Synchrotron Beamline," Omega Optical Inc., Brattleboro VT January 19, 2016.
4. "Coherent X-ray Scattering Heterodyne Effect During Thin Film Deposition," X-ray Scattering Contractors Meeting. Hosted by the Department of Energy Basic Energy Sciences, Division of Materials Science and Engineering, Gaithersburg, MD. November 5, 2014.
5. "A Plethora of Polarization," ECHO Science Center, Burlington VT. July 26, 2014
6. In-situ x-ray diffraction studies of solution-cast organic semiconductor films deposited by the pen-writer method," Workshop on In-situ synchrotron studies of the kinetics of nanostructured, self-assembled, thin-film formation, 2013 Advanced Light Source User Meeting, Berkeley CA, October 7 - 9, 2013
7. "From Snowflakes to Semiconductors," Full Professor Lecture, Burlington VT. February 5, 2013
8. "Fundamental Mechanisms of Roughening and Smoothing During Thin Film Growth," R.L. X-ray Scattering Contractors Meeting. Hosted by the Department of Energy Basic Energy Sciences, Division of Materials Science and Engineering, Warrenton VA. November 8, 2012.
9. "Fundamental Mechanisms of Roughening and Smoothing During Thin Film Growth," X-ray Scattering Contractors Meeting. Hosted by the Department of Energy Basic Energy Sciences, Division of Materials Science and Engineering, Warrenton VA. November 15, 2010.
10. "Pattern-formation in sapphire and smoothing in WSi2," R.L. Headrick. Workshop on pattern formation by ion bombardment. Harvard University, Cambridge MA. August 18, 2010.
11. "In-situ surface scattering," Presented at the workshop on Excitonic Photovoltaic Materials and Devices: Research Opportunities at The National Synchrotron Light Source and the Center for Functional Nanomaterials, Joint Photon Sciences Institute, Brookhaven National Laboratory, Upton NY. June 10, 2010. http://jpsi.bnl.gov/events/excitonic/

CURRICULUM VITAE

VALERI N. KOTOV

March 2017

University of Vermont
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Education

1996 — Ph.D. in Physics, Clarkson University, Potsdam, NY, USA.
Topic: Disordered Interacting Particle Systems, Advisor: G. Forgacs.
M.S. in Physics (1993)

1990 — M.S. in Theoretical Physics, Sofia University, Sofia, Bulgaria.
(Nuclear and Elementary Particle Physics Specialization)

Employment and Professional Experience

2015 – — Associate Professor, Department of Physics,
University of Vermont, Burlington, VT.

2009–2015 — Assistant Professor, Department of Physics,
University of Vermont, Burlington, VT.

2005–2009 — Research Assistant Professor, Department of Physics &
Department of Electrical and Computer Engineering
Boston University, Boston, MA.
Research Areas: Quantum Magnetism and Graphene.

2001–2005 — Senior Assistant (with research and teaching duties), Institute of
Theoretical Physics, Swiss Federal Institute of Technology (EPFL) &
University of Lausanne, Lausanne, Switzerland.
Teaching and Research in Condensed Matter Theory
(Strongly Correlated Electron Systems).

1998–2001 — Research Associate, Department of Physics, University of Florida,
Gainesville, FL.
Research in Strongly Correlated Systems and Magnetic Materials.

1996–1998 — Research Associate, School of Physics, University of New South Wales,
Sydney, Australia.
Research in Quantum Spin Systems and Frustrated Magnetism.

1992–1995 — Graduate Teaching Assistant, Physics Department, Clarkson University.
Undergraduate Physics Courses: Problem Sessions, Some Lectures.

Awards and Fellowships

1995	Outstanding Graduate Student Award, Clarkson University.
1990–91	Research Fellowship, Department of Theoretical Physics, Sofia University.
1991	Outstanding Student Award of the Bulgarian Ministry of Higher Education.

Scientific Background

- Condensed Matter Theory and Quantum Many-Body Theory

Main Areas of Research

- The Physics of Graphene: Electron Correlations, Impurity Effects.
- Quantum Magnetism: Dimerized Spin Systems, Frustrated Magnets, Novel Quantum Phases, Quantum Phase Transitions.
- Strongly Correlated Electronic Materials.

Major Research Accomplishments

- Theory of van der Waals Interactions between Strained Graphene Layers.
- Theory of Electron-Electron Interactions in Strained Graphene.
- Theory of Magnetic Moment Formation in Isotropic and Strained Graphene.
- Theory of Nonlinear Screening of Coulomb Impurities and Interaction Effects in the Polarization of Graphene.
- Graphene in Strong External Fields: Prediction of Coulomb Impurity Effects in "Massive" Graphene, Charging of the Vacuum and Nanoscale Charge Distribution.
- Theory of Incommensurate Magnetic Correlations and Transport in Underdoped High-T_c Cuprate Superconductors.
- Theory of Exotic Weak Antiferromagnetic Order in Strongly Frustrated Spin Systems, such as Pyrochlore Magnets.
- Theory of Collective Excitations and Many-Body Effects in Low-Dimensional Quantum Antiferromagnets with Dimerization and Frustration.
- Accurate Description of Quantum Disordered (Dimerized) Phases and Quantum Phase Transitions in Antiferromagnets.
- Theoretical Modeling of Strongly Correlated Electronic Materials: Novel Molecular Magnets, Spin Dimer and Spin-Peierls Compounds, and Superconducting Oxides.

Teaching at the University of Vermont (partial list)

- "Electricity and Magnetism," PHYS 213 (Fall 2009, Fall 2010, Fall 2011)
- "Mechanics," PHYS 211 (Spring 2010, Spring 2011)
- "Solid State Physics," PHYS 341 (Spring 2012)
- "Fundamentals of Physics I," PHYS 051 (Fall 2012/13/14)

Service at the University of Vermont

- College of Arts and Sciences (CAS) Curriculum Committee (Fall 2012)
- CAS RANSS (Research Awards in the Natural and Social Sciences) Committee (Spring 2013)
- Colloquium committee/Dept. of Physics (2010-2013)
- Graduate committee/Dept. of Physics and Materials Science Program (2010-2012)
- Co-Chair: Physics Graduate Committee (2012-current)
- Organizer, Condensed Matter and Materials Physics Seminar/Dept. of Physics (2010, 2011)
- Faculty search committee/Dept. of Physics (2010/2013)
- Thesis committee member: L. Zhou, S. Wo, and Y. Zhang (Ph.D. Materials Science, 2010-12)
  Thesis committee chair: Evan Malina (M.S. Mechanical Engineering, 2011)

Supervision of students and research scholars at UVM

Current graduate students: Noah Wilson (Physics, 2014–), Nathan Nichols (Materials Science, 2014–)
Postdoctoral research associate: Dr. Anand Sharma (2010–2014)
M.S. in Physics: Peter Harnish (2013–14)
Honors thesis student: Christopher Libby (2010–2011)
Ph.D. Materials Science: Kasey Hulvey (Spring 2011–)
Undergraduate research projects (work/study, readings and research):
Eli Kinigstein (Spring 2010, Spring 2011), Johannes Haslmayr (Spring 2010).

Teaching Experience (prior to UVM)

- "Advanced Solid State Physics" Course, covering Quantum Many-Body Physics
  University of Lausanne & Swiss Federal Institute of Technology (Lausanne)
  Academic Years 2002-04 (Assistant of Prof. F. Mila)
- Invited Lecturer, Graduate Series "Field Theoretical Methods in Condensed Matter Physics" on the Topic "Low-Dimensional Quantum Spin Systems" (6 Lectures),
  The University of New South Wales, Sydney, Fall 1997.
- Teaching Assistant for all Major Undergraduate Physics Courses at
  the Physics Department, Clarkson University, Potsdam, NY, Academic Years 1992-95.
  TA for Math. Physics Course, Dept. of Physics, Sofia University, Sofia (Bulgaria), 1990-91

- Students Supervised:
  (1.)Diploma thesis work (after 4-th year) of A. Lüscher, 2003/defended 2003.
  Swiss Federal Institute of Technology, Lausanne (co-supervised with Prof. F. Mila)
  (2.)Ph.D. thesis work of P. Shevchenko, 1997-98/defended 1999.
  The University of New South Wales, Sydney (co-supervised with Prof. O. Sushkov)
  (3.)Ph.D. thesis work of D.X. Yao, 2006-07/defended 2007.
  Boston University, Boston, MA (co-supervised with Prof. D. Campbell)

Professional Activities and Service

- Member, American Physical Society, European Physical Society.

- Visiting scholar at the Department of Physics, Yale University (Oct.–Nov. 2000).

- Gordon Godfrey visiting scholar, University of New South Wales, Australia (May-June 2011).

- Visiting member, Kavli Institute for Theoretical Physics Program on the Physics of Graphene, University of California, Santa Barbara, January 2012.

- Organizer, Condensed Matter Theory Journal Club, University of Florida, Spring/Fall 2000.
  Coordinator, Graphene Group Meeting, Boston University, Spring/Fall 2007.

- Chair, Tutorial Session on Graphene: APS March Meeting 2013, Baltimore.

- Organizer and Chair, Tutorial Session on Graphene: APS March Meeting 2014, Denver.

- Chair, Focus Session Graphene: Magnetic Properties, APS March Meeting 2010, Portland.

- Referee for Conference Proceedings: Highly Frustrated Magnetism 2003 (Grenoble), International Conference on Strongly Correlated Electron Systems, SCES2001 (Ann Arbor), SCES2007 (Houston), International Conference on Magnetism'97 (Cairns).

- Referee for Nature Physics, the European Physical Journal B, Europhysics Letters, Physical Review Letters, and Physical Review B. Referee for NSF and DOE grant proposals.

- Member of the International Advisory Board of the journal Advanced Electronic Materials.

Invited Talks

(34.) *"Magnetic and Valley Order in Graphene on Boron Nitride,"*
Monash Centre for Atomically Thin Materials,
Monash University, Melbourne (Australia), May 2016.

(33.) *"Magnetic and Valley Order in Graphene on Boron Nitride,"*
Gordon Godfrey Theoretical Physics Seminar,
University of New South Wales, Sydney (Australia), May 2016.

(32.) *"Ultra Thin Van der Waals Materials,"*
Advanced Next Generation Energy Leadership (ANGEL) Symposium, U. Vermont, Oct 2016.

(31.) *"Valley Order and Loop Currents in Graphene on Boron Nitride,"*
Condensed Matter Physics Seminar, University of Missouri, Columbia, May 2015.

(30.) *"Electron-Electron Interactions in Graphene,"*
Tutorial Session on Graphene, March Meeting of the American Physical Society,
Baltimore, MD, March 17, 2013.

(29.) *"Anisotropic Dirac Liquids and Solids: Strained Graphene and Related Systems,"*
Condensed Matter Physics Seminar, University of Oklahoma, Norman, March 2013.

(28.) *"Anisotropic Dirac Liquids and Solids: Strained Graphene and Related Systems,"*
Theoretical Condensed Matter Physics Principal Investigators Meeting,
U.S. Department of Energy, Office of Basic Energy Sciences, Rockville, MD, August 2012.

(27.) *"Correlations in Graphene,"* Condensed Matter Physics Seminar, Boston University, April 2012.

(26.) *"Correlations in Graphene,"*
Condensed Matter and Surface Sciences Colloquium, Ohio University, Athens, March 2012.

(25.) *"Deconfined Spinons at a Quantum Critical Point,"*
Condensed Matter Physics Seminar, University of Oklahoma, Norman, October 2011.

(24.) *"The Spinon Gas Model and its Numerical Tests: Deconfined Spinons at 2D Quantum Phase Transition,"* Workshop on Synergies between Field Theory and Exact Computational Methods in Strongly Correlated Quantum Matter,
International Centre for Theoretical Physics (ICTP), Trieste (Italy), July 2011.

(23.) *"Deconfined Spinons at 2D Quantum Phase Transition,"*
Gordon Godfrey Theoretical Physics Seminar,
University of New South Wales, Sydney (Australia), June 2011.

(22.) *"Exploring the New Physics of Graphene,"*
Physics Colloquium, University of Missouri, Columbia, October 2010.

(21.) *"Correlations in Graphene,"*
Physical Sciences Seminar, IBM T.J. Watson Research Center, Yorktown Heights, May 2010.

(20.) *"Exploring the New Physics of Graphene,"*
Physics Colloquium, University of New South Wales, Sydney (Australia), May 2010.

(19.) *"Graphene in a Strong Coulomb Field,"*
Condensed Matter Theory Kids Seminar, Harvard University, April 2009.

(18.) *"Exploring the New Physics of Graphene,"*
Physics Colloquium, University of Vermont, Burlington, February 2009.

(17.) *"Exploring the New Physics of Graphene,"*
Physics Colloquium, University of North Dakota, Grand Forks, February 2009.

(16.) *"Exploring the New Physics of Graphene,"*
Physics Colloquium, University of Kentucky, Lexington, December 2008.

(15.) *"Quantum Phase Transitions beyond the Dilute Bose Gas Limit,"*
Condensed Matter Theory Seminar, Boston University, February 2007.

(14.) *"Incommensurate Magnetism in Underdoped Cuprates,"*
Colloquium, National Pulsed Magnetic Field Laboratory, Toulouse (France), December 2004.

(13.) *"Exotic Order in Quantum Antiferromagnets,"*
Theoretical Physics Seminar, LPTL, Université Pierre et Marie Curie, Paris (France), May 2004.

(12.) *"Exotic Order in Quantum Antiferromagnets,"*
Theoretical Physics Seminar, Université Paul Sabatier, Toulouse (France), March 2004.

(11.) *"Dimerized Phases and Quantum Phase Transitions in Antiferromagnets,"*
Colloquium, Institut Laue-Langevin (ILL), Grenoble (France), November 2002.

(10.) *"Dimerized Phases in Quantum Antiferromagnets,"*
Condensed Matter Seminar, Swiss Federal Institute of Technology (ETHZ),
Zurich (Switzerland), November 2002.

(9.) *"Universal Quantum Critical Scaling in Quantum Spin Ladder Systems,"*
Condensed Matter Theory Seminar, University of Lausanne, Lausanne (Switzerland), Oct. 2001.

(8.) *"The Novel Quasi-One-Dimensional Spin Ladder Material* $(C_5H_{12}N_2)_2CuBr_4$*:*
Behavior in High Magnetic Field and Universal Quantum Critical Scaling,"
Condensed Matter Seminar, University of Florida, Gainesville, December 2000.

(7.) *"Low-Energy Excitations and Spontaneous Dimer Order in the 2D* $J_1 - J_2$ *Model,"*
Kavli Institute for Theoretical Physics Conference on Quantum Magnetism,
University of California, Santa Barbara, August 1999.

(6.) *"Low-Energy Excitations and Dimer Order in the Two-Dimensional* $J_1 - J_2$ *Model,"*
Condensed Matter Theory Seminar, Yale University, New Haven, April 1999.

(5.) *"Dimer Phases and Quantum Transitions in Low-Dimensional Antiferromagnets,"*
Condensed Matter Seminar, University of Florida, Gainesville, February 1999.

(4.) *"Spin Liquids and Quantum Phase Transitions in Low-Dimensional Antiferromagnets,"*
Theoretical Physics Seminar, The Australian National University, Canberra, May 1998.

(3.) *"Low-Dimensional Quantum Spin Systems,"*
Invited Series of Six Lectures for Postgraduate Students.
The University of New South Wales, Sydney (Australia), Fall 1997.

(2.) *"Non-Perturbative Methods in Disordered Interacting Systems,"*
Theoretical Physics Seminar, The University of New South Wales, Sydney, October 1996.

(1.) *"Instanton Approach to Interacting Random Systems,"*
Theoretical Division (T-11) Seminar, Los Alamos National Laboratory, Los Alamos, Aug. 1995.

Conference Presentations and other Talks
(contributed, unless stated otherwise; first author is the presenter)

(50.) *"Anomalous Magnetic Response of Two-Dimensional Materials,"*
V.N. Kotov, S. Sengupta, M. Furis, and O. Sushkov;
"Critical wetting instabilities of light gases on graphene"
A. Del Maestro, S. Sengupta, N. Nichols, and V.N. Kotov;
"Superfluid ^{4}He phases on strained graphene,"
N. Nichols, V.N. Kotov, and A. Del Maestro;
March Meeting of the American Physical Society, New Orleans, LA, 2017.

(49.) *"Emergence of Spin-Valley Order in Graphene on Hexagonal Boron Nitride,"*
University of Vermont, Physics Colloquium, Sept. 2016

(48.) *"SU(4) quantum spin liquids in critical Coulomb impurity lattices,"*
X. Dou, V.N. Kotov, and B. Uchoa;
"Helium adsorption potential near mechanically deformed graphene,"
N. Nichols, A. Del Maestro, and V.N. Kotov;
"Exotic Charge Polarization near Dirac Cone Merging Transition in Graphene-based Systems,"
N. Wilson, O. Myers, T. Lakoba, and V.N. Kotov;
"Novel Infrared Dynamics of Cold Atoms on Hot Graphene,"
S. Sengupta, V.N. Kotov, and D.P. Clougherty,
March Meeting of the American Physical Society, Baltimore, MD, 2016.

(47.) *"Dispersion Forces of Adatoms on Deformed Graphene,"*
V.N. Kotov, March Meeting of the American Physical Society, San Antonio, TX, 2015.

(46.) *"Valley order and loop currents in graphene on hexagonal boron nitride,"*
B. Uchoa, V.N. Kotov, and M. Kindermann,
March Meeting of the American Physical Society, San Antonio, TX, 2015.

(45.) *"Interaction phenomena in graphene,"*
V.N. Kotov, Theory group seminar, University of New South Wales, Sydney (Australia), Jan. 2015.

(44.) *"Interaction phenomena at topological transitions in strongly anisotropic Dirac materials,"*
V.N. Kotov, March Meeting of the American Physical Society, Denver, CO, 2014.

(43.) *"Van der Waals forces and electron-electron interactions in two strained graphene layers,"*
A. Sharma, P. Harnish, A. Sylvester, and V.N. Kotov,
March Meeting of the American Physical Society, Denver, CO, 2014.

(42.) *"Excitonic Pairing between Strained Graphene Layers,"*
P. Harnish, A. Sharma, and V.N. Kotov,
March Meeting of the American Physical Society, Denver, CO, 2014.

(41.) *"Polarization Waves around Coulomb Impurities in Strained Graphene,"*
V.N. Kotov, A. Sharma, and A.H. Castro Neto,
March Meeting of the American Physical Society, Baltimore, MD, 2013.

(40.) *"Spontaneous Gap Formation in Uniaxially Strained Graphene,"*
A. Sharma, V.N. Kotov, and A.H. Castro Neto,
March Meeting of the American Physical Society, Baltimore, MD, 2013.

(39.) *"Graphene: The Thinnest Material in Nature,"*
V.N. Kotov, Physics Colloquium, University of Vermont, Burlington, September 2012.

(38.) *"Spontaneous gap formation in uniaxially strained Graphene,"*
A. Sharma, V.N. Kotov, and A.H. Castro Neto,
Gordon Research Conference on Correlated Electron Systems (Correlations and Topology in Electron Systems), Mount Holyoke, MA, June 2012.

(37.) *"Formation of Localized Magnetic States on Adatoms in Uniaxially Strained Graphene,"*
A. Sharma and V.N. Kotov,
March Meeting of the American Physical Society, Boston, MA, 2012.

(36.) *"Deconfined Spinons at a Quantum Critical Point,"*
V.N. Kotov, Condensed Matter and Materials Physics Seminar, Univ. of Vermont, Sept. 2011

(35.) *"Electron-electron interactions and anisotropic Dirac fermions in graphene,"*
A. Sharma, V.N. Kotov, and A.H. Castro Neto,
19-th International Conference on Electronic Properties of Two-Dimensional Systems (EP2DS19), Tallahassee, FL, July 2011.

(34.) *"Thermodynamics of deconfined bosonic spinons in two dimensions,"*
V.N. Kotov, A.W. Sandvik, and O.P. Sushkov,
March Meeting of the American Physical Society, Dallas, TX, 2011.

(33.) *"Electron-electron interactions in strained graphene,"*
A. Sharma and V.N. Kotov, March Meeting of the American Physical Society, Dallas, TX, 2011.

(32.) *"Spin and Valley Polarization on deep Coulomb States in Graphene,"*
V.N. Kotov, V.M. Pereira, B. Uchoa, and A.H. Castro Neto,
March Meeting of the American Physical Society, Portland, OR, 2010.

(31.) *"Spin and Valley Polarization on deep Coulomb States in Graphene,"*
V.N. Kotov, V.M. Pereira, B. Uchoa, and A.H. Castro Neto,
Graphene Week 2010, University of Maryland, April 2010.

(30.) *"Polarization and Many-Body Phenomena in Massive Graphene,"*
V.N. Kotov, V.M. Pereira, B. Uchoa, and A.H. Castro Neto,
March Meeting of the American Physical Society, Pittsburgh, PA, 2009.

(29.) *"Polarization and Many-Body Phenomena in Massive Graphene,"*
V.N. Kotov, V.M. Pereira, B. Uchoa, and A.H. Castro Neto,
Boston Area CarbOn Nanoscience (BACON) Day Conference, Boston University, June 2009.

(28.) *"Coulomb Impurity Screening in Graphene,"* V.N. Kotov,
March Meeting of the American Physical Society, New Orleans, LA, 2008.

(27.)(invited) *"Adatoms in Graphene,"*
A.H. Castro Neto, V.N. Kotov, J. Nilsson, V.M. Pereira, N.M.R. Peres, and B. Uchoa,
Graphene Week 2008, International Centre for Theoretical Physics, Trieste (Italy), August 2008.

(26.) *"Correlation Energy Effects in Graphene,"* V.N. Kotov and A.H. Castro Neto,
March Meeting of the American Physical Society, Denver, CO, 2007.

(25.) *"Quantum Phase Transition of Heisenberg Antiferromagnet with Four-Spin Ring Exchange,"*
D.-X. Yao, V.N. Kotov, A.H. Castro Neto, and D.K. Campbell
March Meeting of the American Physical Society, Denver, CO, 2007.

(24.) *"Are Stripes Generically Important for High-T_c cuprates?,"*
V.N. Kotov, A.H. Castro Neto, and O.P. Sushkov,
Gordon Research Conference on Correlated Electron Systems, Mount Holyoke, MA, June 2006.

(23.) *"Transport Anisotropy due to Spiral Spin Order in Underdoped Cuprates,"*
V.N. Kotov and O.P. Sushkov, APS March Meeting, Baltimore, MD, 2006.

(22.) *"Spiral Spin Order and Transport Anisotropies in Underdoped Cuprates,"* V.N. Kotov,
International Workshop on Effective Models for Low-Dimensional Strongly Correlated
Systems, Peyresq (France), September 2005.

(21.) *"Stability of the Spiral Phase and Superconductivity in the Two-Dimensional t-J model,"*
O.P. Sushkov and V.N. Kotov, International Conference on Spectroscopies
in Novel Superconductors (SNS04), Sitges (Spain), July 2004.

(20.) *"Quantum Phases in Frustrated Coupled-Tetrahedra Systems,"*
V.N. Kotov, F. Mila, and M.E. Zhitomirsky, Workshop on Materials with Novel Electronic Properties,
Les Diablerets (Switzerland), September 2003.

(19.) *"Quantum Singlet Dynamics in Frustrated Coupled-Tetrahedra Systems,"*
V.N. Kotov, M. Elhajal, M.E. Zhitomirsky, and F. Mila,
International Conference on Highly Frustrated Magnetism (HFM2003),
Institut Laue-Langevin, Grenoble (France), August 2003.

(18.) *"Quantum Singlet Dynamics in Frustrated Coupled-Tetrahedra Systems,"* V.N. Kotov,
Meeting on Oxides with Remarkable Properties, Caen-Colleville (France), May 2003.

(17.) *"Spin-Peierls Transition in NaV_2O_5 in High Magnetic Fields: Charge
Fluctuation Effects,"*
V.N. Kotov, S. Bompadre, A. Hebard, D. Hall, G. Maris, J. Baas, and T.T.M. Palstra,
Condensed Matter Physics Conference (JMC8), Marseille-Luminy (France), August 2002.

(16.) *"Competition between Valence Bond Liquid and Solid phases in the Kagome
Antiferromagnet,"* V.N. Kotov and F. Mila,
19-th General Conference of the European Physical Society (Condensed Matter Division),
Brighton (UK), April 2002.

(15.) *"Spontaneously Dimerized Quantum Phases in Antiferromagnets,"*
V.N. Kotov, W.H. Zheng, J. Oitmaa, and O.P. Sushkov,
Swiss Physical Society Annual Meeting, EPFL, Lausanne (Switzerland), March 2002.

(14.) *"The Kondo Lattice Model from strong-coupling viewpoint,"* V. N. Kotov and P.J. Hirschfeld,
International Conference on Strongly Correlated Electron Systems (SCES2001),
Ann Arbor, MI, August 2001.

(13.) *"The Kondo Lattice Model from Local Viewpoint,"* V.N. Kotov and P.J. Hirschfeld,
March Meeting of the American Physical Society, Seattle, WA, 2001.

(12.) *"The Magnetic Spin Ladder $(C_5H_{12}N_2)_2CuBr_4$: High Field Magnetization and Scaling Near Quantum Criticality,"*
V.N. Kotov, B.C. Watson, M.W. Meisel, D.W. Hall, G.E. Granroth, M.T. Montfrooij, S.E. Nagler, D.A. Jensen, R. Backov, M.A. Petruska, G.E. Fanucci, and D.R. Talham,
Gordon Conference on Correlated Electron Systems, Plymouth, NH, June 2000.

(11.) *"Critical Dynamics of Singlet Excitations in Frustrated Quantum Spin Systems,"*
V.N. Kotov, M.E. Zhitomirsky, and O.P. Sushkov,
International Workshop on Latest Developments in Low-Density and Low-Dimensional Electron Systems (LD3), University of Florida, Gainesville, March 2000.

(10.) *"Magnetic Bound States in the Spin Dimer Compound $SrCu_2(BO_3)_2$,"*
V.N. Kotov and S. Hershfield,
March Meeting of the American Physical Society, Minneapolis, MN, 2000.

(9.) *"Spin-Peierls transition in NaV_2O_5 in high magnetic fields,"*
A. Hebard, S. Bompadre, V.N. Kotov, D. Hall *et al.*,
March Meeting of the American Physical Society, Minneapolis, MN, 2000.

(8.) *"Zero-bias anomalies in magnetic hexaborides,"*
S. Hershfield and V.N. Kotov,
March Meeting of the American Physical Society, Minneapolis, MN, 2000.

(7.) *"Structure of the Spin-Liquid Phase of the $J_1 - J_2$ Model,"*
V.N. Kotov, W.H. Zheng, J. Oitmaa, and O.P. Sushkov,
March Meeting of the American Physical Society, Atlanta, GA, 1999.

(6.) *"Novel Approach to Description of Spin-Liquid States in Low-Dimensional Quantum Antiferromagnets,"* V.N. Kotov, W.H. Zheng, J. Oitmaa, and O.P. Sushkov,
March Meeting of the American Physical Society, Los Angeles, CA, 1998.

(5.) *"Renormalization Group Approach to 1D Electron-Phonon Models,"* V.N. Kotov,
Statistical Mechanics Meeting'97, The University of New South Wales,
Sydney (Australia), November 1997.

(4.) *"Local Impurities in Two-Dimensional Quantum Antiferromagnets,"*
V.N. Kotov, J. Oitmaa, and O.P. Sushkov,
International Conference on Magnetism, Cairns (Australia), July 1997.

(3.) *"Quantum Spin Ladders with Dimerization,"* V.N. Kotov and J. Oitmaa,
Statistical Mechanics Meeting'96, University of Melbourne, Melbourne (Australia) 1996.

(2.) *"Density of States of a Model Interacting Disordered System,"* V.N. Kotov and G. Forgacs,
72-nd Statistical Mechanics Meeting, Rutgers University, Piscataway, NJ, 1995

(1.) *"Density of States in Interacting Disordered Systems: an Instanton Approach,"*
V.N. Kotov and G. Forgacs,
Statistical Physics at the 45-th Parallel, Syracuse University, Syracuse, NY, 1995.

VALERI N. KOTOV

Refereed Publications

Total citations = 2452, h-index = 22

Citation metrics and links to articles available at:
`http://scholar.google.com/citations?user=NebmKN8AAAAJ`

Most articles (including recently submitted) also available at:
`http://arxiv.org/find/cond-mat/1/au:+Kotov_V/0/1/0/all/0/1`

52. "Excitonic Mass Gap in Uniaxially Strained Graphene,"
A. Sharma, V.N. Kotov, and A.H. Castro Neto,
Submitted to Physical Review B, Preprint at: http://arxiv.org/abs/1702.03551

51. "Infrared Dynamics of Cold Atoms on Hot Graphene Membranes,"
S. Sengupta, V.N. Kotov, and D.P. Clougherty,
Physical Review B **93**, 235437 (2016)

50. "Adsorption by design: tuning atom-graphene van der Waals interactions via mechanical strain,"
N.S. Nichols, A. Del Maestro, C. Wexler, and V.N. Kotov,
Physical Review B **93**, 205412 (2016)

49. "Designing Quantum Spin-Orbital Liquids in Artificial Mott Insulators,"
X. Dou, V.N. Kotov, and B. Uchoa,
Scientific Reports **6**:31737 (2016),
http://www.nature.com/articles/srep31737

48. "Valley Order and Loop Currents in Graphene on Hexagonal Boron Nitride,"
B. Uchoa, V.N. Kotov, and M. Kindermann,
Physical Review B **91**, 121412(R) (2015), Rapid Communication,
Preprint at: http://arxiv.org/abs/1404.5005

47. "Van der Waals forces and electron-electron interactions in two strained graphene layers,"
A. Sharma, P. Harnish, A. Sylvester, V.N. Kotov, and A.H. Castro Neto,
Physical Review B **89**, 235425 (2014),
Preprint at: http://arxiv.org/abs/1402.3369

46. "Effect of Uniaxial Strain on Ferromagnetic Instability and Formation of Localized Magnetic States on Adatoms in Graphene,"
A. Sharma,V.N. Kotov, and A.H. Castro Neto,
Physical Review B **87**, 155431 (2013),
Preprint at: http://arxiv.org/abs/1301.3169

45. "Interacting Anisotropic Dirac Fermions in Strained Graphene and Related Systems,"
A. Sharma,V.N. Kotov, and A.H. Castro Neto,
submitted to Physical Review Letters (2012),
Preprint at: http://arxiv.org/abs/1206.5427

44. "Electron-Electron Interactions in Graphene: Current Status and Perspectives,"

V.N. Kotov, B. Uchoa, V.M. Pereira, F. Guinea, and A.H. Castro Neto,
Reviews of Modern Physics **84**, 1067 (2012).

43. "Thermodynamics of a gas of deconfined bosonic spinons in two dimensions,"
A.W. Sandvik, V.N. Kotov, and O.P. Sushkov,
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V.N. Kotov, D.X. Yao, A.H. Castro Neto, and D.K. Campbell,
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V.N. Kotov, B. Uchoa, and A.H. Castro Neto,
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V.N. Kotov, submitted to Physical Review B, under revision, Preprint: http://arxiv.org/abs/0810.1051

39. "Quantum Phase Transition in the Four-Spin Exchange Antiferromagnet,"
V.N. Kotov, D.X. Yao, A.H. Castro Neto, and D.K. Campbell,
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A.H. Castro Neto, V.N. Kotov, J. Nilsson, V.M. Pereira, N.M.R. Peres, and B. Uchoa,
for the Proceedings of the "Graphene Week 2008," ICTP, Trieste, arXiv:0812.2072.
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37. "Polarization Charge Distribution in Gapped Graphene: Perturbation Theory and Exact Diagonalization Analysis,"
V.N. Kotov, V.M. Pereira, and B. Uchoa,
Physical Review B **78**, 075433 (2008).
Selected for the Virtual Journal of Nanoscale Science & Technology (September 8, 2008).

36. "Supercritical Coulomb Impurities in Gapped Graphene,"
V.M. Pereira, V.N. Kotov, and A.H. Castro Neto,
Physical Review B **78**, 085101 (2008).
Selected for the Virtual Journal of Nanoscale Science & Technology (August 18, 2008).

35. "Localized Magnetic States in Graphene,"
B. Uchoa, V.N. Kotov, N.M.R. Peres, and A.H. Castro Neto,
Physical Review Letters **101**, 026805 (2008).
Selected for the Virtual Journal of Nanoscale Science & Technology (July 21, 2008).

34. "Screening of Coulomb Impurities in Graphene,"
I.S. Terekhov, A.I. Milstein, V.N. Kotov, and O.P. Sushkov,
Physical Review Letters **100**, 076803 (2008).
Selected for the Virtual Journal of Nanoscale Science & Technology (March 10, 2008).

33. "Electron-Electron Interactions in the Vacuum Polarization of Graphene,"

V.N. Kotov, B. Uchoa, and A.H. Castro Neto,
Physical Review B **78**, 035119 (2008).

32. "AC Hopping Magnetotransport Across the Spin Flop Transition in Lightly Doped La_2CuO_4,"
O.P. Sushkov and V.N. Kotov,
Physical Review B **77**, 054506 (2008).

31. "Quantum Phase Transitions beyond the Dilute Bose Gas Limit,"
V.N. Kotov, D.X. Yao, A.H. Castro Neto, and D.K. Campbell,
for Proceedings of SCES07, Houston, arXiv:0704.2439.

30. "Negative Hopping Magnetoresistance and Dimensional Crossover in Lightly Doped Cuprate Superconductors,"
V.N. Kotov, O.P. Sushkov, M.B. Silva Neto, L. Benfatto, and A.H. Castro Neto,
Physical Review B **76**, 224512 (2007).

29. "Stability of the Spiral Phase and Superconductivity in the Two-Dimensional t-J model,"
O.P. Sushkov and V.N. Kotov,
Journal of Physics and Chemistry of Solids **67**, 99 (2006).

28. "Spiral Spin Order and Transport Anisotropy in Underdoped Cuprates,"
V.N. Kotov and O.P. Sushkov,
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V.N. Kotov and O.P. Sushkov,
Physical Review B **72**, 184519 (2005).

26. "Dzyaloshinsky-Moriya Induced Order in the Spin-Liquid Phase of the Pyrochlore Antiferromagnet,"
V.N. Kotov, M. Elhajal, M.E. Zhitomirsky, and F. Mila,
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25. "Theory of Incommensurate Magnetic Correlations across the Insulator-Superconductor Transition in underdoped $La_{2-x}Sr_xCuO_4$,"
O.P. Sushkov and V.N. Kotov,
Physical Review Letters **94**, 097005 (2005).

24. "Weak Antiferromagnetism and Dimer Order in Quantum Systems of Coupled Tetrahedra,"
V.N. Kotov, M.E. Zhitomirsky, M. Elhajal, and F. Mila,
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23. "Stability of the Spiral Phase in the Two-Dimensional Extended t-J Model,"
V.N. Kotov and O.P. Sushkov,
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A. Lüscher, R.M. Noack, Gr. Misguich, V.N. Kotov, and F. Mila,
Physical Review B **70**, 060405(R) (2004).

21. "Superconducting Spiral Phase in the Two-Dimensional t-J Model,"
O.P. Sushkov and V.N. Kotov,
Physical Review B **70**, 024503 (2004).

20. "Patterns of Symmetry Breaking in Systems of Coupled Tetrahedra,"
V.N. Kotov, M.E. Zhitomirsky, M. Elhajal, and F. Mila,
Journal of Physics: Condensed Matter **16**, S905 (2004).

19. "The Kondo Lattice Model from Strong-Coupling Viewpoint,"
V.N. Kotov and P.J. Hirschfeld,
Physica B **312**, 174 (2002); arXiv:cond-mat/0111587.

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B.C. Watson, V.N. Kotov, M.W. Meisel, D.W. Hall, G.E. Granroth, M.T. Montfrooij, S.E. Nagler, D.A. Jensen, R. Backov, M.A. Petruska, G.E. Fanucci, and D.R. Talham,
Physical Review Letters **86**, 5168 (2001).

17. "Critical Dynamics of Singlet Excitations in a Frustrated Spin System,"
V.N. Kotov, M.E. Zhitomirsky, and O.P. Sushkov, Physical Review B **63**, 064412 (2001).

16. "Collective Singlet Excitations and Evolution of Raman Spectral Weights in the 2D Spin Dimer Compound $SrCu_2(BO_3)_2$,"
P. Lemmens, M. Grove, M. Fischer, G. Güntherodt, V.N. Kotov, H. Kageyama, K. Onizuka, and Y. Ueda,
Physical Review Letters **85**, 2605 (2000).

15. "Spontaneous Dimer Order, Spectrum of Excitations, and Quantum Phase Transitions in the $J_1 - J_2$ Heisenberg Model,"
V.N. Kotov, J. Oitmaa, O.P. Sushkov, and W.H. Zheng,
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14. "Spin-Peierls Transition in NaV_2O_5 in High Magnetic Fields,"
S.G. Bompadre, A.F. Hebard, V.N. Kotov, D. Hall, G. Maris, J. Baas, and T.T.M. Palstra,
Physical Review B **61**, R13321 (2000).

13. "Nature of the Transition from the Spontaneously Dimerized to the Neel Phase in the Two-Dimensional $J_1 - J_2$ Model,"
V.N. Kotov and O.P. Sushkov,
Physical Review B **61**, 11820 (2000).

12. "Low-Energy Singlet and Triplet Excitations in the Spin-Liquid Phase of the Two-Dimensional $J_1 - J_2$ Model,"
V.N. Kotov, J. Oitmaa, O.P. Sushkov, and W.H. Zheng,
Physical Review B **60**, 14613 (1999).

11. "Spectrum of Elementary and Collective Excitations in the Dimerized S=1/2 Heisenberg Chain with Frustration,"
P.V. Shevchenko, V.N. Kotov, and O.P. Sushkov,
Physical Review B **60**, 3305 (1999).

10. "Excitation Spectrum and Ground State Properties of the S=1/2 Heisenberg Ladder with Staggered Dimerization,"
V.N. Kotov, J. Oitmaa, and W.H. Zheng,
Physical Review B **59**, 11377 (1999).

9. "Novel Approach to Description of Spin Liquid Phases in Low-Dimensional Quantum Antiferromagnets,"
O.P. Sushkov, V.N. Kotov, W.H. Zheng, and J. Oitmaa,
Physica B **261**, 1023 (1999).

8. "Excitation Spectrum of the S=1/2 Spin Ladder with Frustration: Elementary Quasiparticles and Many-Particle Bound States,"
V.N. Kotov, O.P. Sushkov, and R. Eder,
Physical Review B **59**, 6266 (1999).

7. "Bound States of Magnons in the S=1/2 Quantum Spin Ladder,"
O.P. Sushkov and V.N. Kotov,
Physical Review Letters **81**, 1941 (1998).

6. "Magnetic Impurity in the Two-Dimensional Heisenberg Antiferromagnet,"
V.N. Kotov, J. Oitmaa, and O.P. Sushkov,
Physical Review B **58**, 8495 (1998).

5. "Novel Approach to Description of Spin Liquid Phases in Low-Dimensional Quantum Antiferromagnets,"
V.N. Kotov, O.P. Sushkov, W.H. Zheng, and J. Oitmaa,
Physical Review Letters **80**, 5790 (1998).

4. "Local Magnetic Impurities in the 2D Quantum Heisenberg Antiferromagnet,"
V.N. Kotov, J. Oitmaa, and O.P. Sushkov,
Physical Review B **58**, 8500 (1998).

3. "Two-Chain Spin Ladder with Frustrating Second-Neighbor Interactions,"
W.H. Zheng, V. Kotov, and J. Oitmaa,
Physical Review B **57**, 11439 (1998).

2. "Local Impurities in Two-Dimensional Quantum Antiferromagnets,"
V.N. Kotov, J. Oitmaa, and O.P. Sushkov,
Journal of Magnetism and Magnetic Materials **177**, 727 (1998).

1. "The Lifshitz Tail in a Model of Interacting Particles,"
G. Forgacs and V. Kotov,
Physical Review B **51**, 11339 (1995).

Thesis Work

Ph.D. Thesis: "The Instanton Method in the Theory of Disordered Interacting Particle Systems," Clarkson University (1996).

M.S. Thesis: "Electronic Spectrum of Quasicrystals with Impurities," Sofia University (1991), (in bulgarian).

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Academic Background:

M.S. in Physics, University of Vermont, Burlington, VT, 2003
Concentrations: ultrasonics, biophysics
Thesis: *Cell Transfection Induced by Ultrasound in the Presence of Encapsulated Microbubbles*
Advisor: Dr. Junru Wu
B.A. in Physics, University of Vermont, Burlington, VT, 2001

Honors and Awards:

Phi Beta Kappa, University of Vermont, 2000
Magna cum laude, University of Vermont, 2001
Recipient: David W. Juenker Award for outstanding senior students majoring in physics, University of Vermont, 2001
Sigma Pi Sigma (national physics honor society), University of Vermont, 2004

Teaching Experience:

Senior Lecturer, August 2016-present
Lecturer, September 2004-August 2016
Physics Department, University of Vermont
Courses instructed: Mechanics, calculus based (lecture & lab);
Mechanics, algebra based (lecture & lab);
Electricity/Magnetism, calculus based (lecture & lab);
Electricity/Magnetism, algebra based (lecture & lab);
Recitations for Mechanics and Electricity/Magnetism
Astronomy labs
Visiting Lecturer, September 2007-June 2009
Physics Department, Saint Michael's College
Courses Instructed: Mechanics (lecture & lab);
Electricity and Magnetism (lecture & lab);
Acoustical Foundations of Music (lecture & lab);
Astronomy labs
Visiting Lecturer, September 2006-February 2007
Physics Department, Middlebury College
Courses Instructed: Electricity and Magnetism (lecture & lab);
Thermodynamics (lecture)
Teaching Assistant, January 2001-May 2003
Physics Department, University of Vermont
Courses instructed: 2 recitations or 2 laboratories each semester for introductory mechanics and electricity/magnetism

Tutor, January 1999-May 2000
Learning Coop, University of Vermont
Tutored students in physics and mathematics

Research and Laboratory Experience:

Research Assistant, June 2006-July 2007
Biophysics/Molecular Physiology Department, University of Vermont
Assisted Dr. Brad Palmer in designing and constructing a microscope stage with micro manipulators for experiments with myofibrils

Research Assistant, September 1998-June 2006
Physics Department, University of Vermont
Assisted Dr. Junru Wu with a variety of projects involving bio-effects of ultrasound including: temperature elevation of soft tissue, transdermal drug delivery, acoustic properties of cardiac stents, sonoporation with applications to gene therapy, cellular anti-cancer drug delivery and antibody introduction

Research skills:
Familiar with use of acoustics equipment (transducers, function generators, oscilloscopes)
Experience with handling biological cells and related lab techniques including incubation, centrifugation, fluorescent microscopy, confocal microscopy, and flow cytometry
Able to design and fabricate basic experimental physics equipment
Fluent in the use of computer software such as Microsoft Excel and *mathematica* for data analysis

Publications:

Wu J, Pepe J, Dewitt W. "Nonlinear behaviors of contrast agents relevant to diagnostic and therapeutic applications," Ultrasound Med Biol 2003; 29:555-562.

Pepe J, Wu J, Rincon M. "Experimental comparison of sonoporation and electroporation in cell transfection applications," Acoustics Research Letters Online 2004; 5:62-67.

Wu J, Chen D, Pepe J, Himberg B, Rincón M. "Application of Liposomes to Sonoporation," Ultrasound Med Biol 2006; 32:429-437

Patents Held:

Methods for the delivery of compounds to cells, 2005, Provisional
Co-inventors: Mercedes Rincon, Junru Wu.

Grants Received:

Helix mini research grant, University of Vermont, summer 1999

JOHN F.W. PERRY

EDUCATION:
Ph.D. – Astrophysics, University of Rochester, 1972
B.A. – Pomona College, 1966

EMPLOYMENT:
1984 – Present: President and founder, Holographics North Inc.
1974 – Present: Lecturer III, Physics Dept, University of Vermont
1997 – 2000: Senior Technician, North Dancer Labs, Shelburne VT
1975 – 1987: Lecturer, Art Dept, University of Vermont
1979 – 1986: Studio Coordinator, L/LC, University of Vermont
1978 – 1979: Assistant Professor, Goddard College
1974 – 1979: Lecturer, Art Dept, Castleton State College
1972 – 1979: Freelance photographer, VT-NH region
1968 – 1971: Research Assistant, University of Rochester
1966 – 1968: Teaching Assistant, University of Rochester
Summer 1966: Teaching Assistant, Harvard Project Physics
Summer 1965: Research Fellow, Pomona College

PUBLICATIONS:
Artist Projects at Holographics North, ISDH-MIT Proc, 2012
NY Times Arts & Leisure, Letters, July 29, 2001
Interview with John Perry, Holography Marketplace, 1999
10 Major Myths of Holography, Holography Marketplace, 1998
Large Format Stereogram Facility, SPIE Proc. Vol. 2043, 1993
Design of Large Format Display Holograms, SPIE Proc. Vol. 1051, 1989
Collaboration with Artists in Large Format, Proc. Intern. Symp. On Display Holography Vol. III, 1988
Large Format Display Holography, SPIE Proc. Vol. 747, 1987
Distribution of Neutral Hydrogen in the Perseus Arm, Astrophysical Journal, 1972

PRIZES & APPOINTMENTS
Science Advisory Committee, Echo at Leahy Center for Lake Studies
Int'l. Hol. Marketers' Ass. Best New Product award, 2005
Int'l. Hol. Marketers' Ass. Best of Year award 2005
Int'l. Hol. Marketers' Ass. Best of Year award, 2003
Int'l. Hol. Marketers' Ass. Best Display Design award, 2003

JURIES:
Canada Council Holography, 1987
Vermont Council on the Arts, 1978

LECTURES & WORKSHOPS:
New England Schools and Colleges, (26) various, 1981-Present
Memorial Art Gallery, Rochester, NY 2013
L/LC, Univ. of Vermont, 2010
Physics Department, 2002 and 2004
Holographic Imaging and Materials Conf, SPIE 1993 (speaker)
Practical Holography III Conference, Lake Forest 1989 (speaker)
3-Dmt Spatial Imaging Conference, Montreal 1989 (speaker)

Intl. Symp. on Display Holography, Lake Forest1988 (speaker)
Practical Holography II Conf, SPIE1987 (speaker, session chair)
New York Museum of Holography, 1987 (featured speaker)
Trent University, Ontario 1985 (featured speaker)
Fleming Museum, Burlington VT 1984 (featured speaker)
Dartmouth College Physics Dept, 1983 (featured speaker)
Montshire Museum of Science, 1982 (featured speaker)

EXHIBITIONS

MIT Museum, Cambridge, MA 2012-2013
MIT Museum, Cambridge, MA 2010-11
L/LC Gallery, Univ. of Vermont, 2010
PACE Gallery, New York (for James Turrell), 2010
PACE Gallery, New York (for James Turrell), 2009
MIT Museum, Cambridge (for Paula Dawson), 2008
PACE Gallery, New York (for James Turrell), 2007
PACE Gallery, New York (for James Turrell), 2005
Queen's Gallery, Buckingham Palace, 2004
Flynndog Gallery, Burlington, 2003
University of Vermont, L/LC Gallery, 1995
Images in Time and Space, Montreal, 1993, 1989
Musee de la Civilization, Ottawa, 1988
Images in Time and space, Montreal, 1987
Musee des Beaux Arts, Mulhouse, France, 1986
Oslo Poetry Festival, Norway, 1986
Lake Forrest College, Illinois, 1985
Basel Art, Switzerland, 1985
McKenzie Gallery, Peterborough, Ontario, 1985
Holographie Galerie, Munich, 1984
Interference Gallery, Toronto, 1984
Museum of Holography, New York, 1984
Arts and Science Center, Nashua NH, 1983
University of Vermont, L/LC Gallery 1981, ‘82, ‘83
Jaffe-Friede Gallery, Dartmouth College, 1983
Museum of Holography, New York, 1982
Montshire Museum of Science, Hanover NH, 1982
Jaffe-Friede Gallery, Dartmouth College, 1978

COLLECTIONS:

56 museums, 53 artists and over 215 companies have purchased work produced by John Perry at Holographics North. See www.holonorth.com for more information.

CURRICULUM VITAE

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Positions: Professor of Physics, University of Vermont (1988-)
Visiting Committee, Arecibo Observatory (2004-6)
Visiting Scientist, Sterrenkundig Instituut 'Anton Pannekoek'
University of Amsterdam, Netherlands (2001-2, 2005, 2009-12)
Visiting Scientist, Raman Research Institute, Bangalore,
India (1988, 1991, 1993-97, 1999, 2001, 2004)
Associate Professor of Physics, Univ. of Vermont (1980-88)
Assistant Professor of Astronomy, Cornell Univ (1974-78)
Scientific Staff, Arecibo Observatory, Arecibo (1970-78)
Visiting Scientist, Radiophysics Div., C.S.I.R.O., Sydney, Australia (1972)

Pre- and Post-doctoral Students & Colleagues: Mateus Teixeira, Emily Smith (Oregan), Stephanie Young (Maryland)
Isaac Backus (Washington), Megan Force (Dartmouth), Isabel Kloumann (Cornell), Jeffrey Herfindal (Auburn); Patrick Weltevrede (Amsterdam);
Stephen Redman (Penn); Joeri van Leeuwen (Utrecht);
R. Ramachandran (Raman Research Institute, Berkeley);
Dipanjan Mitra (Raman Research Institute, MPI Radioastronomy);
Jeffrey Kern (New Mexico Tech);Mark McKinnon (New Mexico Tech), Kyriakh Xilouris (Thessaloniki); N. Rathnasree (UVM); Joel Weisberg (Iowa)

Courses Taught: Astronomy 5—Introductory Astronomy (complete)
(Fall 2001-03)
Astronomy 57—History and Practice of Ancient Astronomy
(Spring 2002-04,06; Fall 2007-9,10-12)
Physics 214—Electrodynamics
(Spring 1982, 85, Fall 2000,04,-06,09,11,13)
Physics 257—Astrophysics
(Spring 1983, 96.00; Fall 1984, 86, 88, 91, 93, 95-6, 97-8, 04,06-8,12,14)
Physics 323—Physics and Philosophy
(Spring 1981)
Physics 323—Pulsar Radio Astronomy
(Spring 1996, 2003, 06)
Women's Studies 174—Women, Science and Nature
(Fall 1990, Spring 1993, 95, 96, 98, 00,02,04,07)

Research 2010-2015 National Science Foundation (PIRE Nanograv)

Support:
2014-2015 Vermont Space Grant/NASA EPSCoR
2007-2012 National Science Foundation (AST 07-07669)
2002-5 Visitor Grant, Netherlands National Science Foundation
2001-2006 National Science Foundation (AST 00-98685)
2000-2005 National Science Foundation (AST 99-86754)
1997-2001 National Science Foundation (INT 97-00668)
1993-1999 National Science Foundation (INT 93-21974)
1990-1994 National Science Foundation (AST 89-17722)
1986-1990 Vermont EPSCoR Research Grant
1983 Research Corporation: Cottrell Grant
1982 UVM Graduate College Research Grant
1981 National Science Foundation (SES 81-03180)
1978 National Science Foundation (SOC 78-1750l)

Honors:
Fulbright Fellowship, India (1994)
Indo-U.S. Fellowship, C. I. E. S. (1991)
Van Allen-Link Fellowship (l968-70)

Listed in:
American Men and Women of Science
Who's Who in Frontier Science and Technology
Who's Who in Society
Who's Who in Technology

Professional Societies:
International Astronomical Union
International Scientific Radio Union (URSI)
American Astronomical Society
Sigma Xi
American Women in Science
National Women's Studies Association
Federation of American Scientists
Union of Concerned Scientists

Conference Organ'tion:
International Astronomical Union Colloquium #128, *The Magnetospheric Structure and Emission Mechanism of Radio Pulsars*,agòw, Poland, June 1990 (with T. H. Hankins)

Books Published:
The Magnetospheric Structure and Emission Mechanism of Radio Pulsars, International Astronomical Union Colloquium #128, Lagòw, Poland (with T. H. Hankins and J. A. Gil), 1992

Language Skills:
Russian (reading and some conversation)
German (reading and some conversation)
Spanish (reading and some conversation)
Sanskrit (some reading)
French (some reading)
Latin (some reading)

LECTURES & COLLOQUIA (2004—):

Raman Research Institute, Bangalore, India "Rotating Subbeam Systems & the Physics of Pulsar Emission" (January 2004).

National Centre for Radio Astrophysics, Pune, India, "Pulsar Emission Dynamics: Not As Our Mothers Taught Us" (January 2007).

Raman Research Institute, Bangalore, India "Connecting Pulsar Phenomena with the Emission Physics" (January 2007).

University of Amsterdam, Sterrenkundig Instituut 'Anton Pannekoek "Connecting Radio Pulsar Phenomena with the Emission Physics" (March 2007).

Physics Department, University of Vermont, "Connecting Radio Pulsar Phenomena with the Emission Physics" (April 2007).

Physics Department, McGill University, Montreal, Canada "Connecting Radio Pulsar Phenomena with the Emission Physics" (May 2007).

Workshop on Pulsar Populations, NRAO Green Bank Observatory, "Nulling, Drifting. Moding and Carousel-Beam Emission" (May 2007).

40 Years of Pulsars, Magnetars & More Symposium, McGill University, "Many Recent Insights Into the Problem of Pulsar Emission" (August 2007).

Frontiers of Astronomy with the World's Largest Radio Telescope, Washington, D.C., "Single Pulse Studies Pulsar Emission Mechanisms" (Sept. 2007).

Middle America Regional Astronomy Conference, Kansas City, MO "Connecting Pulsar Phenomena with the Emission Physics" (March 2008).

Low Frequency Pulsar Science, Lorentz Center, Leiden University, "Connecting Single Pulse Behaviour with Pulsar Emission Physics" (June. 2008).

Armagh Observatory, Armagh, Northern Ireland, "Connecting Radio Pulsar Phenomena with the Emission Physics" (July 2008).

INAF -Arcetri Workshop "Pulsars in their Diversity", Elba, Italy "Conal/Core Phenomena and the Physics of Pulsar Emission" (June 2009).

National Centre for Radio Astrophysics, Pune, India, "A New Era of Pulsar Emission Investigation" (January 2010).

Raman Research Institute, Bangalore, India "A New Era of Pulsar Investigation" (January 2010).

National Centre for Radio Astrophysics, Pune, India, "Single Pulsar Polarimetry and the Problem of Pulsar Emission" (January 2012).

Raman Research Institute, Bangalore, India "Single Pulsar Polarimetry and the Problem of Pulsar Emission" (January 2012).

Electromagnetic Radiation from Pulsars & Magnetars, Zielona Gora Poland "An Introduction to Radio Pulsar B0943+10" (24-27 April 2012).

Physics Dept., McGill University "Synchronous X-ray and Radio Mode Changing in a Pulsar: Evidence for Rapid Global Transformation of the Magnetosphere" (January 2013).

Physics Department, UVM "Synchronous X-ray and Radio Mode Changing in a Pulsar: Evidence for Rapid Global Transformation of the Magnetosphere" (February 2013).

Astrophysics Colloquium, Goddard Space Flight Center, Greenbelt, MD "Synchronous X-ray and Radio Mode Changing in a Pulsar: Evidence for Rapid Global Transformation of the Magnetosphere" (February 2013).

Astronomy Department, Penn State University "Synchronous X-ray and Radio Mode Changing in a Pulsar: Evidence for Rapid Global Transformation of the Magnetosphere" (February 2013).

National Radio Astronomy Observatory/University of Virginia Astronomy "Synchronous X-ray and Radio Mode Changing in a Pulsar: Evidence for Rapid Global Transformation of the Magnetosphere" (February 2013).

Astronomy Department, Cornell University "Synchronous X-ray and Radio Mode Changing in a Pulsar: Evidence for Rapid Global Transformation of the Magnetosphere" (March 2013).

Astronomy Department, Dartmouth College "Synchronous X-ray and Radio Mode Changing in a Pulsar: Evidence for Rapid Global Transformation of the Magnetosphere" (April 2013).

National Radio Astronomy Observatory/Very Large Array, Socorro, NM "Synchronous X-ray and Radio Mode Changing in a Pulsar: Evidence for Rapid Global Transformation of the Magnetosphere" (April 2013).

California Institute of Technology, Pasadena, CA "Synchronous X-ray and Radio Mode Changing in a Pulsar: Evidence for Rapid Global Transformation of the Magnetosphere" (May 2013).

University of California, Berkeley, "Synchronous X-ray and Radio Mode Changing in a Pulsar: Evidence for Rapid Global Transformation of the Magnetosphere" (May 2013).

Arecibo Observatory 50th Anniversary Symposium, "Understanding Pulsars with Arecibo, Past Present and Future" (October 2013).

Arecibo Observatory, NanoGrav Workshop, "Core Emission, Dominant in Faster Normal Pulsars; Where are the MSPs" (February 2014).

ASTRON, Dwingeloo, Netherlands, "Core Emission, Dominant in Faster Normal Pulsars; Where are the MSPs" (March 2014).

ASTRON, "Understanding the Plasma-Physical Processes Behind Pulsar Radiation" (March 2015).

REFEREED ASTRONOMICAL PUBLICATIONS:

Quasi-sinusoidal oscillation in arrival times of

pulses from NP 0532 (with D. W. Richards, G. H. Pettengill, and C. C. Counselman III), *Astrophysical Journal* **160**, L1-L6 (1970).

Pulsar NP 0532: Average polarization and daily variability at 430-MHz (with D. B. Campbell and C. Heiles), *Nature* **225,** 527-528 (1970).

The 1969 solar occultation of the Crab Nebula pulsar NP 0532, Ph.D. thesis, University of Iowa 70-26 (1970).

Pulsar NP 0532: Properties and systematic polarization of individual strong pulses at 430 MHz (with C. Heiles and D. B. Campbell, *Nature* **226,** 529-531 (1970).

Pulsar NP 0532: Polarization of strong pulses at 430 MHz as seen with 300 kHz bandwidth (with C. Heiles), *Nature* **227**, 1330-1331 (1970).

Pulsar NP 0532: Absence of average polarization at 111.5 MHz (with C. Heiles and D. B. Campbell) *Nature* **228**, 1074 (1970).

Radio pulse shapes, flux densities and dispersion of pulsar NP 0532 (with J. M. Comella, H. D. Craft, Jr., D. W. Richards, D. B. Campbell, and C. C. Counselman III), *Astrophysical Journal* **162,** 707 (1970).

Multipath delay distortion of radio pulses from NP 0532 (with C. C. Counselman III), *Astrophysical Journal* **166,** 513-523 (1971).

Pulsar NP 0532: Frequency structure in individual strong pulses (with C. Heiles), *Nature Physical Science* **231**, 97-99 (1971).

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On the polarisation of high intensity pulses in radio pulsars (with N. Rathnasree), *Pulsars: Problems & Progress (IAU Colloquium #160)*, Sydney, Australia, p. 265 (January 1996), Astronomical Society of the Pacific, San Francisco, 1996.

Polar-fluxtube emission "weather" of pulsar 0943+10: polarisation, modes, & theoretical implications (with A. A. Deshpande) *Pulsar Astronomy—2000 and Beyond (IAU Colloquium #177)*, Bonn, Germany, p. 155 (January 2000), Astronomical Society of the Pacific, San Francisco, 2000.

Single-pulse polarimetry of the Vela pulsar (with J. S. Kern & T. H. Hankins) *Pulsar Astronomy — 2000 and Beyond (IAU Colloquium #177)*, Bonn, Germany, p. 257 (January 2000), Astronomical Society of the Pacific, San Francisco, 2000.

Pulse-Sequence Cartography of Conal Single Pulsars (with A. A. Deshpande) *Pulsar Astronomy*

— *2000 and Beyond (IAU Colloquium #177)*, Bonn, Germany.

Mapping the subbeam structure of radio pulsars using drifting subpulses *Nederlandse Astronomen-club* , Dalfsen, Netherlands (May 2001)

Probing drifting & nulling mechanisms (with A.G.J. van Leeuwen, B. W. Stappers, R. E. Edwards, & R. Ramachandran) General Assembly of the International Astronomical Union, Sydney, Australia (July 2003).

Q- to B-mode transition recovery dynamics in pulsar B0943+10 (with S. A. Suleymanova) Nijmegen Conference on Drifting Subpulses, Nijmegen, Netherlands (June 2004).

The extreme radio emission of PSR B0656+14 —Is B0656+14 a very nearby Rotating Radio Transient? (with P. Weltevrede, B.W. Stappers & G.A.E. Wright) *Neutron Stars & Pulsars — About 40 years After Discovery (363rd Heraeus Seminar)*, Bad Honnef, Germany (14-19 May 2006).

Many recent insights into the problem of pulsar radio emission *40 Years of Pulsars: Millisecond Pulsars, Magnetars and More*, Montreal, Canada (12-17 August 2007).

Remembering the Early Days of Pulsars at the Arecibo Ionospheric Observatory *40 Years of Pulsars: Millisecond Pulsars, Magnetars and More*, Montreal, Canada (12-17 August 2007).

Double notches – a zoom into the microphysics of coherent radio emission from pulsars (with J. Dyks & R. Rudak) *40 Years of Pulsars: Millisecond Pulsars, Magnetars and More*, Montreal, Canada (12-17 August 2007).

Periodic nulls in pulsar B1133+16 (with J. L. Herfindal) *40 Years of Pulsars: Millisecond Pulsars, Magnetars and More*, Montreal, Canada (12-17 August 2007).

Periodic nulling in pulsars exhibiting conal single and double profiles (with J. L. Herfindal) *40 Years of Pulsars: Millisecond Pulsars, Magnetars and More*, Montreal, Canada (12-17 August 2007).

Are partial cones aberrated cones? (with D. Mitra & S. Sarala) *40 Years of Pulsars: Millisecond Pulsars, Magnetars and More*, Montreal, Canada (12-17 August 2007).

On the absolute broadband polarization behaviour of PSR B0329+54 (with D. Mitra) *40 Years of Pulsars: Millisecond Pulsars, Magnetars and More*, Montreal, Canada (12-17 August 2007).

On the subpulse modulation and carousel circulation time of PSR B1857–26 (with D. Mitra) *40 Years of Pulsars: Millisecond Pulsars, Magnetars and More*, Montreal, Canada (12-17 August 2007).

Exploring the absolute OPM geometry of outer conal emission (with D. Mitra) *40 Years of Pulsars: Millisecond Pulsars, Magnetars and More*, Montreal, Canada (12-17 August 2007).

Interaction between nulls and emission in pulsar B0834+06 (with G.A.E. Wright) *40 Years of Pulsars: Millisecond Pulsars, Magnetars and More*, Montreal, Canada (12-17 August 2007).

The periodic nulls of pulsar J1819+1305: evidence of subbeam carousel circulation? (with G.A.E. Wright) *40 Years of Pulsars: Millisecond Pulsars, Magnetars and More*, Montreal, Canada (12-17 August 2007).

New insights into pulsar nulling (with S. L. Redman) *40 Years of Pulsars: Millisecond Pulsars, Magnetars and More*, Montreal, Canada (12-17 August 2007).

The drift modes of pulsar B0943+10 (with B.W. Stappers) *40 Years of Pulsars: Millisecond Pulsars, Magnetars and More*, Montreal, Canada (12-17 August 2007).

Emission of pulsar B0943+10 in the burst mode: remarkably continual changes in the subpulse drift rate and in integrated pulse shape (with S. A. Suleymanova) *40 Years of Pulsars: Millisecond Pulsars, Magnetars and More*, Montreal, Canada (12-17 August 2007).

Pulsar B0656+14: highly unusual emission properties and a local RRAT (with P. Weltevrede, B.W. Stappers & G.A.E. Wright) *40 Years of Pulsars: Millisecond Pulsars, Magnetars and More*, Montreal, Canada (12-17 August 2007).

Core Emission in Classical Conal Double Profiles (with Stephanie A.E. Young) *Electromagnetic Radiation from Pulsars & Magnetars*, Zielona Gora Poland (24-27 April 2012).

Modal Sequencing in an 8-Hour GMRT Observation of Pulsar B1822–09 (with Crystal L. Latham and Dipanjan Mitra) *Electromagnetic Radiation from Pulsars & Magnetars*, Zielona Gora Poland (24-27 April 2012).

Mode Segregation Analysis of Pulsar B1237+25 (with Emily Smith & Dipanjan Mitra) *Electromagnetic Radiation from Pulsars & Magnetars*, Zielona Gora Poland (24-27 April 2012).

Investigations of the Emission Geometry of the Four-Comonent Radio Pulsar J0631+1036 (with Mateus M. Teixeira and Geoffrey A.E. Wright) *Electromagnetic Radiation from Pulsars & Magnetars*, Zielona Gora Poland (24-27 April 2012).

Invited: The Centrality of Pulsar Core Radiation *Extreme-Astrophysics in an Ever-Changing Universe Time-Domain Astronomy in the 21st Century; Celebrating Prof. J. H. Seiradakis' 40-yr Career* (16-20 June 2014, Ierapetra, Crete)

The Core/Cone Emission-Beam Geometry of Millisecond Pulsar J0337+1715 *ibid*

Natal Supernovae “Kicks” are Parallel to Pulsar Rotation Axes *ibid*

Inferring Pulsar Microstructure Time Scales (with Mihir Arjunwadkar and Dipanjan Mitra) *ibid*

MISCELLANEOUS LECTURES, ARTICLES AND APPEARENCES:

Barnard College Colloquium Series, Columbia University, New York City, “Pulsars and Their Role in Modern Astrophysics” (March 1980).

Sigma Xi Lecture, University of Vermont, Burlington, “Pulsar Astronomy and the Arecibo Observatory” (January 1983).

“Not on Our Soil” (with Ellen Dorsch and Cynthia Reid), *Vermont Vanguard Press* (October 30 - November 6, 1983).

Department of Electrical Engineering, University of Vermont, Burlington, “Weapons and Technology: Development and Implications of the New Nuclear Arms Race” (November 1983).

Bailey/Howe Library Series, University of Vermont, Burlington, “First-Strike Weapons: Technology and Strategies” (January 1984).

Department of Psychology, University of Vermont, Burlington, “First-Strike Weapons: Technology and Strategies” (February 1984).

University Honors Series, University of Maine, Presque Isle, “Weapons and Technology: Development and Implications of the New Nuclear Arms Race” (February 1984).

“Military Shadow Hovers Over Our Space Program” (Op-Ed piece) *Burlington Free Press* (March 18, l984).

“A Costly Error in Space” (Op-Ed piece) *Sunday Rutland Herald & Times Argus* (April 8, 1984).

Department of Geology, University of Vermont, Burlington, “First-Strike Weapons: Technology and Strategies” (April 1984).

“U.S. Account of KAL 007 Shooting Still Doesn't Fly” (Op-Ed piece) *Burlington Free Press* (August 31, 1984).

“Flight 007: Reassessing Responsibility” (Op-Ed piece) *Sunday Rutland Herald and Sunday Times Argus* (September 2, l984).

Arecibo Observatory, Arecibo, Puerto Rico “First-Strike Weapons: Technology and Strategies” (June 1984).

Norwich University, Northfield, Vermont, “First-Strike Weapons: Development and Implication of the New Nuclear Arms Race” (January 1985).

American Women in Psychology National Meeting, New York City, “Is Militarism a Feminist Issue?” (March 1985).

National Women's Studies Association Meeting, Seattle, Washington, “Toward A Feminist Critique of Militarism” (June l985).

“Facts Warrant New Investigation into Downing of KAL Flight 007” (Op-Ed piece) *Burlington Free Press* (September 15, 1985).

“Propping Up the Patriarchy: The Silenced Soldiering of Military Nurses” (with Joy A. Livingston) *Women and Therapy* **5** (1), 107-119 (Spring 1986).

Genes and Gender Conference VI, New York City, “A Feminist Analysis of Militarism” (with Ellen Dorsch and Joy A. Livingston) (February 1986).

University of South Florida Conference Fortress America: Militarism and American Society, “A Feminist Critique of Militarism” (February 1986).

New England Women's Studies Association Conference Women's Power: Working for Change, Haverill, MA, “Patriarchal and Feminist Power: A Feminist Critique of Militarism” (with Ellen Dorsch and Joy A. Livingston) (April 1986).

Physics Department, University of Vermont, “Astronomical Travels in China and the Soviet Union” (October 1986).

Raman Research Institute, Bangalore, India, “The Star Wars: Science and Militarism in the USA” (May 1988).

Women's Studies Series, University of Vermont, Burlington, “Nature, Women, and the Scientific Enterprise” (February 1989).

Bailey/Howe Library Series, University of Vermont, Burlington, “Issues in Contemporary Poland” (with Shirley Gedeon) (February 1989).

“The Quest for Exotic Pulsars” *Griffith Observer* (Third Prize in the Griffith Observatory Writing Contest) (with Mary Fillmore) (December 1989).

Vermont Astronomical Society, “Arecibo—Construction and Development of the World’s Largest Radio Telescope” (December 4, 1989).

Burlington Women’s Council Series “Women in Science, Women in Nature” (with Linda Vance) (March 20, 1990).

Book Review. “Boffin: A Personal Story of the Early Days of Radar, Radio Astronomy and Quantum Optics” by R. Hanbury Brown, *Current Science* **66**, 974 (25 June 1994).

Vermont Public Radio *Switchboard* Program "Astronomy" (with Mark Breen) (March 6, 1997).

Middlebury Radio WFAD*Talk of Vermont* Program on "Astronomy" (with Jeff Kaufman) (February 3, 1999).

Newsletter article. "Understanding Pulsar Weather" *Arecibo Observatory Newsletter* (October 1999).

Newsletter article. "Pulsar Nulling: New Insights from (Almost) Nothing" (with J. L. Herfindal, S. R. Redman & G.A.E. Wright) *Arecibo Observatory Newsletter* (June 2007).

CURRICULUM VITAE

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Education:

1991	Ph. D. Applied Physics, Yale University.
1987	M. Phil. Applied Physics, Yale University.
1984	M. S. Applied Physics, Yale University.
1983	B. S. Engineering Physics (with highest distinction) University of Maine.

Employment:

2004-	Senior Lecturer in Physics Unversity of Vermont Burlington, Vermont
1996-2003	Lecturer in Physics Unversity of Vermont Burlington, Vermont
1995-96	Lecturer in Physics Bates College Lewiston, Maine
1995	Assistant Professor of Physics (temporary) University of Maine Orono, Maine
1994	Assistant Professor of Physics University of Maine at Farmington Farmington, Maine
1993	Research Associate Department of Agricultural Resource Economics University of Maine

	Orono, Maine (development of Multispecies Fisheries Model)
1992-93	Assistant Professor of Physics (temporary) University of Maine Orono, Maine
1992	Visiting Research Associate Institute for Theoretical Atomic and Molecular Physics Harvard University Cambridge, Massachusetts
1987	Research Associate T-12 (Atomic and Molecular Physics) and Center for Nonlinear Studies Los Alamos National Laboratory Los Alamos, New Mexico
1983-91	Graduate Student and Teaching Assistant Yale University New Haven, Connecticut
1984	Research Assistant (Physical Oceanography) Bigelow Laboratory for Ocean Sciences Boothbay Harbor, Maine

References: Available on request

Publications:

Papers:

1.) M.M. Sanders, R.V. Jensen, P.M. Koch, and K.A.H. van Leeuwen, ``Chaotic Ionization of Highly Excited Hydrogen Atoms'', Nuclear Physics B, Proceedings Supplement *2*, 578 (1987).

2.) R.V. Jensen, S.M. Susskind, and M.M. Sanders, ``Microwave Ionization of Highly Excited Hydrogen Atoms: A Test of the Correspondence Principle'', Physical Review Letters *62*, 1476, (1989).

3.) R.V. Jensen, M.M. Sanders, M. Saraceno and B. Sundaram, ``Inhibition of Quantum Transport due to `Scars' of Periodic Orbits'', Physical Review Letters *63*, 2771, (1989).

4.) R.V. Jensen, S.M. Susskind, and M.M. Sanders, ``Chaotic Ionization of Highly Excited Hydrogen Atoms: Comparison of Classical and Quantum Theory with Experiment'', Physics Reports *201* #1 March, 1991.

5.) M. M. Sanders and R.V. Jensen, "Classical Theory of Chaotic Ionization of Highly-excited Hydrogen atoms.", American Journal of Physics, vol. 64, number 1, January, 1996.

6.) M. M. Sanders and R.V. Jensen, "Classical Theory of Chaotic Ionization of Rydberg Helium Atoms", American Journal of Physics, vol. 64, number 8, August, 1996.

Books:

1.) M.M. Sanders, ``Energy from the Oceans.'' in *The Energy Sourcebook: A guide to Technology, Resources, and Policy*, Ruth Howes and Anthony Fainberg, editors, AIP, 1991.

Thesis:
1) Malcolm M. Sanders, *Chaotic Ionization of One and Two Electron Atoms*. unpublished, 1991.

Professional Activities:

Member: American Physical Society

Attended Chautauqua Short Course: Promoting Active Learning in Introductory Physics Courses II, Dickinson College, Carlisle, PA, June 2000

NSF-CCLI (Physics Section) Panelist for grant reviews, Washington DC, July 2003

Visiting Scholar - Dublin City University, Dublin, Ireland. Sabbatical Year 2005-06

Juan Manuel Vanegas, Ph.D.

Assistant Professor
Department of Physics
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Cook Physical Science Bldg. A521
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About me

I was born in a small town in the plains of Casanare, Colombia. My brother and I left Colombia when I was 14 years old and came to the United States searching for a better future. With scarce resources, but determined to succeed, I pursued my passion for science to discover how nature works. I am inspired by the microscopic universe of the cell, where billions of molecules come together to propel life.

Research Interests

Soft condensed matter physics, multi-scale modeling, molecular simulations (classical and *ab initio*), continuum mechanics, mechanical signal transduction, mechanosensitive channels, ion channels, membrane biophysics.

Education

Ph.D. Biophysics. University of California, Davis. **2011.** Mentors: Dr. Marjorie Longo and Dr. Roland Faller.

M.S. Biochemistry and Biophysics. Oregon State University. **2007**

B.S. Physics. Oregon State University. **2005**

Professional Experience

2016 – Assistant Professor. Dept. of Physics, University of Vermont. Burlington, VT.

2013 – 16 Post-doctoral Researcher. Nanobiology Dept., Center for Biological and Materials Sciences. Sandia National Laboratories. Albuquerque, NM. Mentor: Dr. Susan B. Rempe.

2011 – 13 Post-doctoral Researcher. Dept. of Applied Mathematics III, Technical Univ. of Catalonia (UPC-BarcelonaTech). Barcelona, Spain. Mentor: Dr. Marino Arroyo.

Teaching Experience

Undergraduate

- Thermal and Statistical Physics (PH265). Instructor. UVM, Spring **2016**.

- Biological Physics (PH222). Instructor. UVM, Fall **2016**.
- Properties of Materials. Lab teaching assistant. UC Davis, Winter **2009** and Winter **2011**.
- Molecular and Cellular Biology. Teaching assistant. OSU, Spring **2006**.
- Biochemistry. Teaching assistant. OSU, Fall **2005** and Winter **2006**.
- Scientific Computing I. Teaching assistant. OSU, Fall **2004**.
- Kaplan Inc. MCAT testing preparation instructor, Summer **2003**.
- Mathematics and Computer Science tutor at Umpqua Community college (**2000–02**).

Graduate

- Colloids, Surface Forces and Techniques. Co-Instructor. UC Davis, Spring **2011**.
- Computational Physics I and II. Teaching assistant. OSU, Winter and Spring **2005**.

Professional Service

- Referee for *Journal of Chemical Physics*, *Journal of Physical Chemistry, Biomechanics and Modeling in Mechanobiology, ACS Applied Materials & Interfaces*.

Department Service

- Physics Active Learning committee (ongoing). Meet weekly for 1-1.5 hours to discuss implementation of active learning physics classroom for lower level courses.

Professional Affiliations

- Member of *American Physical Society, American Chemical Society, Biophysical Society*.

Mentoring

- Computer Science undergraduate student intern at Sandia (**2014**)
- Physics Ph.D. student at UPC-BarcelonaTech (**2012–13**)
- Bioscience M.S. student intern at UC Davis (**2010**)

Grant Proposals

Awarded

2015 – 18 "Exploiting the microbial achilles heel for new broad-spectrum anti-microbials". Budget: **$1.5 M for 3 years.** Role: Co-investigator with Principal investigator S. B. Rempe, and co-investigators M. S. Kent, E. Spoerke, and D. Ye. Laboratory Directed Research and Development Proposal 16-0416, Sandia National Laboratories. No funds provided for UVM.

Submitted – Not awarded

2017 – 21 "Reaction Mechanism in Therapeutic Asparaginases: Re-designing Enzymes for Faster Catalysis and Customized Specificity". Overall budget: **$1.4 M for 4 years.** UVM sub-award budget: **$106K.** Role: Co-investigator with Principal investigator S. B. Rempe, and co-Principal investigators S. Sukharev and J. Weinstein. Submitted to NIH.

Supercomputing Proposals

2013 – 15 "Fusion of pathogenic viruses studied by molecular dynamics simulations". Awarded hours: **5,300,000.** Role: Co-investigator with S. B. Rempe. Sandia National Laboratories.

2012 – 14 "Role of hopanoids in the mechanical properties of model bacterial membranes and function of mechano-sensitive channels". Awarded hours: **2,500,000.** Role: **Principal investigator** with co-investigators M. Arroyo and A. Torres-Sanchez. Barcelona Supercomputing Center.

2009 – 11 "A systematic molecular modeling study of the effect of lipid bilayer composition on resistance to alcohol-induced changes". Awarded Hours: **4,600,000.** Role: Co-investigator with principal investigator R. Faller. Pacific Northwest National Laboratory.

Open Source Projects

- GROMACS-LS – A custom version of the GROMACS molecular simulation package designed for local stress/pressure calculations. Main developer with A. Torres-Sanchez. [Link]
- MDStressLib – A standalone modular C++ library intended for local stress calculations from molecular simulations. Main developer with A. Torres-Sanchez. [Link]

Skills

Computational

- Classical molecular dynamics (GROMACS, NAMD, PLUMED)
- *Ab-initio* electronic structure methods (Gaussian, Q-Chem, VASP)
- Molecular modeling and scientific visualization (UCSF Chimera, VMD, Paraview)
- Python (numpy, scipy, matplotlib)
- Programming (C, C++, bash, java)
- Image processing and analysis (Gwyddion, SimplePCI, ImageJ)
- Parallel computing (MPI)
- Linux/Unix and Linux cluster administration

Laboratory

- Atomic force microscopy
- Fluorescence microscopy
- Basic electron microscopy and 3D image reconstruction
- Preparation of supported membranes and giant unilamellar vesicles
- Protein expression and purification
- Design and creation of custom laboratory equipment
- Liquid chromatography
- SDS-PAGE and electrophoresis
- Absorption, fluorescence, and stopped-flow spectroscopy

Awards and Fellowships

- Biophysical Society Committee on Inclusion and Diversity travel award to attend the 61st annual BPS meeting in New Orleans, LA (**2017**)
- International R&D100 Top (Gold) Award Winner in Green Technology for "CO_2 Memzyme," *R&D Magazine* (**2015**)
- Federal Labs Consortium Award in Notable Technology Development for "Nano-Stabilized Enzymatic Membrane for CO_2 Capture" (**2014**)
- UC Davis George and Dorothy Zolk fellowship (**2010**)
- UC Davis Graduate Research mentorship (**2008**)
- NIH Initiative to Maximize Student Diversity fellowship (**2007**)
- OSU International Cultural Service Program (ICSP) scholarship (**2003-05**)
- OSU Provost scholarship (**2002-05**)

Special Courses and Workshops

- Short course on multi-scale modeling of materials at the Friedrich-Alexander University in Erlangen, Germany. (February 18 – 22, **2013**)
- Workshop on numerical methods in applied science and engineering. Barcelona, Spain. (January 21 – 24, **2013**)
- Entrepreneurship Academy at UC Davis (September 13 – 17, **2010**)

Publications – Google Scholar *h* – index = 7 (270 citations) [Link]

Peer-reviewed Journal Articles

1. Torres-Sanchez, A., **Vanegas, J. M.,** and Arroyo, M. Geometric derivation of the microscopic stress: A covariant central force decomposition. J. Mech. Phys. Solids 93, 224 – 239 (2016) [Link]

2. Anishkin, A., **Vanegas, J. M.**, Rogers, D. M., Lorenzi, P. L., Chan, W. K., Purwaha, P., Weinstein, J. N., Sukharev, S., and Rempe, S. B. Catalytic role of the substrate defines

specificity of therapeutic L-asparaginase. *J. Mol. Biol.* 427, (17), 2867–2885 (**2015**) [Link]

3. Torres-Sanchez, A., **Vanegas, J. M.***, and Arroyo, M. Examining the mechanical equilibrium of microscopic stresses in molecular simulations. *Phys. Rev. Lett.* 114, 258102 (**2015**). *Co-first author [Link]

4. **Vanegas, J. M.*** and Arroyo, M. Force transduction and lipid binding in MscL: A continuum-molecular approach. *PLoS ONE*, 9 (12), e113947. (**2014**). *Corresponding author [Link]

5. **Vanegas, J. M.,** Torres-Sanchez, A., and Arroyo, M. Importance of force decomposition for local stress calculations in biomembrane molecular simulations. *J. Chem. Theory Comput.*, 10, 691-702. (**2014**) [Link]

6. **Vanegas, J. M.**, Contreras, M. F., Faller, R., and Longo, M. L. Role of unsaturated lipid and ergosterol in ethanol tolerance of model yeast biomembranes. *Biophys. J.*, 102, 507-516. (**2012**) [Link]

7. **Vanegas, J. M.**, Longo, M. L., and Faller, R. Crystalline, ordered and disordered lipid membranes: Convergence of stress profiles due to ergosterol. *J. Am. Chem. Soc.*, 133, 3720-3723. (**2011**) [Link]

8. **Vanegas, J. M.**, Faller, R., and Longo, M. L. Influence of ethanol on lipid/sterol membranes: Phase diagram construction from AFM imaging. *Langmuir*, 26, 10415-10418. (**2010**) [Link]

9. Goksu, I., **Vanegas, J. M.**, Blanchette, C. D., Lin, W-C., and Longo, M. L. AFM for structure and dynamics of biomembranes. *Biochim. Biophys. Acta*, 1788, 254-266. (**2009**) [Link]

Manuscripts in Preparation and Under Review

10. Torres-Sanchez, A., Zhao, Q., **Vanegas, J.M.**, Arroyo, M., Purohit, P.K. Progressive unfolding of coiled-coil proteins as a phase transition: A molecular-to-continuum study. *Under review*.

11. **Vanegas, J. M.**, Heinrich, F., Akgun, B., Satija, S., Zheng, A., Kielian, M., Carson, B., Rempe, S. B., and Kent, M. S. Insertion of dengue E protein into lipid bilayers resolved by neutron reflectivity and molecular dynamics simulations. *Under review.*

12. Chaudhari, M. I., **Vanegas, J. M.**, and Rempe, S. B. Divalent ion hydration structures and free energies: A step toward assessing hydration mimicry in ion permeation. *In preparation. Invited article at Accounts of Chemical Research.*

Theses

1. **Vanegas, J. M.** Model yeast biomembranes: Understanding structure and mechanical properties from simulations and experiments. Ph.D. Dissertation. University of California, Davis. (2011)

2. **Vanegas, J. M.** Alkylation kinetics of the human retinoid X receptor α using cysteine as a local probe. Master's Thesis. Oregon State University. (2007)

Conference Proceedings and Abstracts

1. **Vanegas, J. M.,** Torres-Sanchez, A., and Arroyo, M. Beyond lateral pressure profiles: Local stress and the traction vector in MD simulations. Biophysical Society 61st annual meeting. New Orleans, Louisiana, USA. (Feb. 11 – 15, **2017**)

2. **Vanegas, J. M.**, Torres-Sanchez, A., and Arroyo, M. Is the microscopic stress computed from molecular simulations in mechanical equilibrium? LAMMPS Users' Workshop and Symposium. Albuquerque, New Mexico, USA. (Aug. 5 – 7th, **2015**)

3. **Vanegas, J. M.**, Anishkin, A., Rogers, D. M., Sukharev, S., and Rempe, S. B. Active role of the substrate during catalysis by the therapeutic enzyme L-asparaginase II. Biophysical Society 59th annual meeting. Baltimore, Maryland, USA. (Feb. 7 – 11, **2015**)

4. **Vanegas, J. M.**, Rogers, D. M., Kent, M. S., and Rempe, S. B. Role of electrostatic interactions in the anchoring of dengue E protein to lipid membranes. Biophysical Society 59th annual meeting. Baltimore, Maryland, USA. (Feb. 7 – 11, **2015**)

5. Torres-Sanchez, A., **Vanegas, J. M.**, and Arroyo, M. Local stress calculations: Importance of force decomposition. 11Th World Congress on Computational Mechanics, Barcelona, Spain. (July 20-25, **2014**)

6. Arroyo, M., Torres-Sanchez, A., **Vanegas, J. M.**, and Rahimi, M. Atomistic and continuum insights into protein-bilayer interactions. CECAM Workshop on Hybrid Models for Protein-Membrane Interactions, Berlin, Germany. (April 2-4, **2014**)

7. **Vanegas, J. M.** and Arroyo, M. Lipid binding and force transduction in the mechanosensitive chanel MscL. Mechanobiology of Proteins and Cells, Biophysical Society meeting. Salisbury Cove, Maine, USA. (Sept. 29 – Oct. 3, **2013**)

8. **Vanegas, J. M.** and Arroyo, M. Role of hopanoids in the mechanics of bacterial membranes and structure of the mechanosensitive channel MscL. Biomembrane Days. Potsdam, Germany. (Sept. 19-21, **2012**)

9. **Vanegas, J. M.** and Arroyo, M. Hopanoids in model bacterial membranes: Structural and mechanical changes in pope bilayers induced by bacteriohopanetetrol. Faraday Discussions 161: Lipids and Membrane Biophysics. London, UK. (Sept. 11-13, **2012**)

10. **Vanegas, J. M.**, Longo, M. L., Faller, R. Ergosterol and temperature modulated changes in dynamic and static properties of DPPC membranes. 241St ACS National Meeting, Anaheim, CA, USA. (March 27-31, **2011**)

11. **Vanegas, J. M.**, Block, D. E., Faller, R., Longo, M. L. Microstructural phase changes of DPPC-ergosterol supported membranes stressed by ethanol. APS March National Meeting, Portland, OR, USA. (March 15-19, **2010**)

12. **Vanegas, J. M.**, Longo, M. L., Faller, R. Structure and phase behavior of cholesterol containing membranes in the presence of ethanol. 54Th Biophysical Society Annual Meeting, San Francisco, CA, USA. (Feb. 20-24, **2010**)

13. **Vanegas, J. M.**, Block, D. E.; Faller, R., Longo, M. L. Effects of temperature on alcohol-induced interdigitation in supported lipid bilayers. 237th ACS National Meeting, Salt Lake

city, UT, USA. (March 22-26, **2009**)

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Professional Experience

September 2015 – Present

Assistant Professor, University of Vermont, Department of Physics, Burlington, VT. Research focused on the electrical and optical characterization of next generation semiconductor materials and thin-film device design with built-in optical resonant structures.
www.uvm.edu/~mwhite25/

February 2011 – June 2015

Assistant Professor, Johannes Kepler University Department of Physical Chemistry, Linz, Austria Responsible for lecturing and guiding student lab practical courses, as well as mentoring undergraduates, graduate students, and post-docs. My group currently consists of two post-docs and a co-advised PhD student with temporary visitors on a regular basis. Head of Device Fabrication and Characterization Lab, and Laser Lab. Research on transient electrical characterization of organic semiconductors and devices including CELIV and nonlinear impedance analysis, ultra-thin, light-weight, and flexible/stretchable solar cells and OLEDs, microstructured organic solar cells, paper substrates for organic devices, and oxide-based hybrid materials.
www.lios.at

September 2009 - December 2010

Post-doctoral Research Assistant, Linz Institute for Organic Solar Cells, Linz, Austria Characterized organic semiconductor materials using transient methods. Used Charge Extraction with Linearly Increasing Voltage (CELIV) to determine charge carrier mobility as a function of device temperature to quantify the Meyer-Neldl behavior of the materials. Constructed small-molecule IR-activated OLEDs. Investigated the causes of anomalous low frequency diode impedance signals.
www.lios.at

2004 - 2009

Graduate Research Assistant, National Renewable Energy Laboratory, Golden, CO Fabrication and characterization of organic photovoltaic devices under the direction of David Ginley. The specific area of research was interface engineering for efficient charge transfer and separation in hybrid oxide-polymer devices.
http://www.nrel.gov/pv/advanced_concepts.html

2002-2003

Undergraduate Research Assistant, Center for Nuclear Physics and Astrophysics, University of Washington, Seattle, WA
Worked with the Eöt-Wash group under Eric Adelberger and Blayne Heckel. Constructed and characterized magnetic torsion pendulums to test for spin-coupled forces.
http://www.npl.washington.edu/eotwash/

Education

2003-2009

PhD University of Colorado, Boulder, CO
Title of thesis: *Effects of charge carrier concentration in hybrid conjugated polymer/oxide photovoltaic devices*
Department of Physics
Area of concentration: Hybrid and organic photovoltaic device physics

1999-2003

B.S. University of Washington, Seattle WA
Double Major in Mathematics and Physics
Departmental Honors in Physics
University Honors Program

Languages spoken

English: Fluent, native language
Spanish: Very proficient. Lived in Spain 1991-1994 with additional 10 semesters of middle-school, high-school, and university level courses.
German: Proficient. Two semesters of courses plus conversational practice living in Austria 2009-2015.
Italian: Conversational

Awards and Grants

($3,000) 2015

University of Vermont Sustainability OVPR Express Award. *Undergraduate research in thin-film, organic semiconductor devices.* Supported by the UVM Office of the Vice President for Research, this award supports four undergraduate research projects for the Spring 2016 semester.

($400) 2015

University of Vermont Sustainability Faculty Fellowship. Supported by the Office of the Provost, this fellowship seeks to develop a learning community—a multidisciplinary faculty cohort engaged in a year-long exploration of sustainability, the scholarship of teaching, learning, collaboration, and community building.

(¥149,985,000 ≈ $1,365,000) 2014

ANGEL, JSPS Brain Circulation Program. 2.5-year travel, materials, and equipment grant to promote the exchange of researchers to and from Yamagata University (YU) Faculty of Engineering in Yonezawa, Japan. Funded by the Japan Society for the Promotion of Science. The project is transferrable, so I will be able to use some of the funds to host Japanese assistant professors and send my own students and postdocs to YU during the 2015-2017 time frame. Co-author and scientific coordinator at JKU.

(€158,700) 2013

3D Solar, "e!Mission.at" Emerging Technologies for Climate and Energy. 2-year academic/industrial collaborative research project with Joanneum Research in Weiz, Austria. Project funded by the FFG, provides 100% support for salary of 1 post-doctoral researcher, materials, and travel. Co-author and co-PI/Institutional director at JKU.

(€5,272) 2013

Sustainable Energy Travel Grant WTZ. Funding provided by the ÖAD supports travel to and from the Czech Academy of Science to form a collaborative research effort between LIOS and the Institute of MacroMolecular Chemistry headed by J. Stejskal. Principal author and co-PI at JKU.

(€226,890) 2012

OLAE+ Transnational Project "DUC3PV". 2-year project involving 3 universities and 2 industrial entities in Germany (Technical University Chemnitz, Altana), Austria (Isovoltaic, JKU/LIOS), and Poland (Polish Academy of Sciences). Support for 1 post-doctoral researcher, 1 PhD student, materials, and travel. Co-author and technical director at partner institute (JKU/LIOS).

(€1,180) 2010

ORGANISOLAR ESF Short Visit Grant (Ref. #3623) Funding for travel to Unversitat Jaume I in Castellon de la Plana, Spain.

2002-2003

Gregory Lynn Andersen Scholarship Full tuition scholarship offered through the physics department at the University of Washington for academic excellence.

Editorial Board

Scientific Reports (Starting Oct 2014)

Reviewing

Journal Review

ACS Applied Materials & Interfaces
Advanced Materials
Advanced Energy Materials
Applied Physics A
Energy & Environmental Science
Journal of Applied Physics
Journal of Luminescence
Journal of Physical Chemistry
Nano Letters
Nature Communications
Organic Electronics
Physics Letters A
Scientific Reports

Grant Review

Israel Science Foundation
U.S. DOE-BES
KAUST CRG
ERC

Experimental Skills

Material Characterization

Photoluminescence
UV-Vis absorption spectroscopy
Four-point probe
Profilometry
X-ray diffraction
Electrostatic voltmeter/Kelvin probe
Atomic force microscopy

Device and Film Fabrication

Pulsed laser deposition
Photolithography
Thermal evaporation
Nanoparticle synthesis
Spin coating
Blade coating

Device Characterization

IV and EQE
Electroluminescence
Nonlinear impedance spectroscopy
CELIV and photo-CELIV
Transient photovoltage
Capacitance-voltage

Software and Programming

IGOR Pro
MATLAB
Mathematica
C++
Labview
LaTeX
Corel Draw

Collaborators

Tsukasa Yoshida
Yamagata University
Yonezawa, Japan

Siegfried Bauer
Johannes Kepler University
Linz, Austria

Takao Someya

Tsuyoshi Sekitani
University of Tokyo
Tokyo, Japan

Mehmet Sarikaya
University of Washington

Alan Aspuru-Guzik
Martin Blood-Forsythe
Harvard University
Cambridge, MA
János Volk
Hungarian Academy of Sciences
Budapest, Hungary
Daniel Gryko
Polish Academy of Science
Warsaw, Poland
Arved Hübler
Tino Zillger
Chemnitz University of Technology
Chemnitz, Germany

Andrew Sutherland
Olga Efremova
Aston University
Birmingham, UK
Bernard Lamprecht
Joanneum Research
Weiz, Austria
Jaroslav Stejskal
Jiri Pfleger
Czech Academy of Science
Institute for Macromolecular Chemistry
Prague, Czech Republic

Teaching and mentoring

Courses

Physics 013, Conceptual Physics University of Vermont, Spring 2017, Lecture class for general students covering introductory and intermediate physics from a conceptual standpoint. 23 students.

Physics 009, Energy & the Environment University of Vermont, Spring 2016, Lecture class for general science students covering a variety of energy related topics. 14 students.

Physics 096, Energy & the Environment Lab University of Vermont, Spring 2016, Laboratory accompanying PHYS 009. 3 students.

Physics 128, Waves & Quanta University of Vermont, Half lecture, half lab on modern physics. Fall 2015: 15 students. Fall 2016: 20 students.

Organic opto-electronics lecture and practical JKU, Winter 2011, 2012, 2013, 2014, Half lecture, half lab practical course of my own design, 6 to 12 students per semester.

Computational tools for experimental scientists JKU, Summer 2011, 2012, 2013, 2014, Lecture course of my own design, 6 to 12 students per semester

Physics 1110, General Physics 1 (Calculus Based) CU Boulder, TA, Fall 2003, Spring 2004, 4 recitation sections each semester, roughly 25 students per section.

Post-docs

Christoph Ulbricht, Post-doctoral researcher, 3D Solar microstructured PV, 2014-present

Lucia Leonat, Post-doctoral researcher, Disposable ultracheap printed paper photovoltaics. 2013-present

PhD students

Ekraj Dahal, PhD student in the University of Vermont Materials Science Program. Bio-inspired organic semiconductors for solar cells. Dec 2016 – Present

Safae Aazou, PhD student from Chouaïb Doukkali University in Morocco. I supervised her 6 month research visit to Linz through the African Network for Solar Energy (ANSOLE) ANEX program in 2012, resulting in 2 publications.

Olena Kozlova, PhD student in Marie Curie Research Training Network (ESTABLIS), co-supervisor Siegfried Bauer, 2012-present

Masters/Diploma students

Justin Paluba, Masters of Materials Science student in the University of Vermont Materials Science Program. Novel contact-layers for solar cells. Dec 2016 – Present

Stefan Kraner, Master of Science, *Measurement of charge carrier mobility and charge carrier concentration of organic photovoltaic diodes under in situ light soaking conditions and varying temperatures*, July 2011

Stefanie Schlager, Diplom Ingenieurin, *Diodes with organic Schottky junctions*, October 2011

Undergraduates

Olivia Sergiovani, Air stable contact layers for solar cells, Spring 2017 - Present
Conner Winkeljohn, Air stable contact layers for solar cells, Spring 2017 - Present
Daniel Abratenko, Air stable contact layers for solar cells, Fall 2016 - Present
Ben Isenhart, Nanosecond pulsed laser stimulation of organic films, Fall 2016 - Present
Natascha Krishnanand, Organic Thin Film Transistors, Fall 2015 – Fall 2016.
Bin Du, Bio-mimetic nano-scale Turing patterns in hybrid thin films, Fall 2015 – Present.
Michael Garrett, Nonlinear impedance spectroscopy, Fall 2015 – Present.
Tyler McLain, Photo-thermal deflection spectroscopy, Spring 2016 – Fall 2017.
Yu (Summer) Jiang, Quinacridone based MIS devices, Spring 2016 – Present.
Michael Arnold, Optical characterization of quinacridone films and crystals, Spring 2016 – Present.
Andrew Larsen, Impedance analysis of copper phthalocyanine MIS and planar heterojunction devices., Spring 2016 – Present.

Pre-College students

Kirby Gordon, Organic thin film transistors & 3D surface maps, Fall 2015 – Spring 2016
Matthias Stummer, Talente – Praktika für Schülerinnen und Schüler, August 2013

Conferences Presentations

Invited Presentations

FUTURMAT2, September 2012, Brindisi, Italy, *Ultra-thin, -light, and -flexible organic solar cells*

International Symposium on Advanced Materials and Electronics, March 2013, Tokyo, Japan, *Ultrathin organic opto-electronics.*

Society for Information Display Mid-Europe Chapter Spring Meeting, April 7, 2014, *Ultrathin Organic Optoelectronics*

University of Michigan, MSE Special Seminar, August 12, 2014, *Substrates, Contacts, and Semiconductors for Organic and Hybrid Photovoltaics*

MRS Fall 2014 Symposium P, *ZnO and CuSCN nanostructures for hybrid solar cells*

IMRC 2016 Symposium A, *ZnO/organic semiconductor hybrid nanostructures for solar energy harvesting*, Cancun, Mexico

EMRS Fall Meeting 2016, Symposium B, *Nanoscale Turing patterns in electrodeposited hybrid thin films*, Warsaw, Poland

MRS Spring Meeting 2017, Symposium SM, *Ultrathin optoelectronic devices: light-weight and extreme flexibility*, Phoenix, AZ (will be in April 2017)

Contributed Presentations

Over 20 oral presentations, and several poster presentations at international conferences, including Materials Research Society, European Materials Research Society, SPIE Optics and Photonics, Electrochemical Society, and many others.

Colloquia

UVM Physics Colloquium, Sept. 16th 2015, *Perovksite solar cells: Is there a PV revolution in progress?*

UVM Electrical Engineering Graduate Seminar, Nov. 13th 2015, *Ultra-thin-film perovskite solar cells*

UVM Renewable Energy Network Tech Talk, March 30th 2016, *Organic Thin-Film Solar PV*

Yamagata University, June 10th 2016, *English in international science*

University of New Hampshire Physics Colloquium, Nov. 4th 2016, *Ultrathin optoelectronic devices.*

UVM Environmental Science Undergraduate Seminar, Feb. 8th 2017, *Low-cost High-Volume PV*

Hosting and Organizing

Advanced Materials for Energy and Bioengineering Applications (AMEBA) Organizer, Dec. 7th – 8th 2015, Burlington, VT.

EMRS Fall 2016 Meeting, Warsaw, Poland, Organizer, Symposium S

Advanced Next Generation Energy Leadership symposium organizer, Oct. 26th 2016, Burlington VT.

Outreach Activities

Mater Christi 8th Grade Science Fair Judge, Burlington VT, Feb. 21st, 2017

Winooski Middle School Family STEM Night, November 10th, 2016

Summer Workshop on Organic Optoelectronics, July – August 2016

Mater Christi 8th Grade Science Fair Judge, Burlington VT, Feb. 18th, 2016

ESTABLIS Marie Curie International Training Network Workshop, Sept. 9th,10th, 2014

i-Front Career Q&A Seminar, Yamagata University, March 17th, 2014

Nanotechnologie Schulwoche, high school students attend lab experiments in nanotechnology, Feb 10-14, 2014

NaNSA Career Q&A Seminar, University of Washington, April 9th, 2013

African Network for Solar Energy, student project coordinator for Safae Aazou, 2012

Photovoltaic Research Dialog, Chamber of Commerce Vienna, Austria, Oct 19th 2011

Publications

Highlights

- **M. S. White**, D. C. Olson, S. E. Shaheen, N. Kopidakis, and D. S. Ginley, "Inverted bulk-heterojunction organic photovoltaic device using a solution-derived ZnO underlayer," *Appl. Phys. Lett.*, vol. 89, no. 14, p. 143517, 2006.
- M. Kaltenbrunner, **M. S. White**, E. D. Glowacki, T. Sekitani, T. Someya, N. S. Sariciftci, and S. Bauer, "Ultrathin and lightweight organic solar cells with high flexibility," *Nat Commun*, vol. 3, p. 770, 2012.
- **M. S. White**, M. Kaltenbrunner, E. D. Głowacki, K. Gutnichenko, G. Kettlgruber, I. Graz, S. Aazou, C. Ulbricht, D. A. Egbe, and M. C. Miron, "Ultrathin, highly flexible and stretchable PLEDs," *Nature Photon*, vol. 7, no. 10, pp. 811–816, 2013.
- E. D. Głowacki, M. Irimia-Vladu, M. Kaltenbrunner, J. Gasiorowski, **M. S. White**, U. Monkowius, G. Romanazzi, G. P. Suranna, P. Mastrorilli, T. Sekitani, S. Bauer, T. Someya, L. Torsi, and N. S. Sariciftci, "Hydrogen-Bonded Semiconducting Pigments for Air-Stable Field-Effect Transistors," *Adv. Mater.*, vol. 25, no. 11, pp. 1563–1569, 2013.
- L. Leonat, **M. S. White**, E. D. Głowacki, M. C. Scharber, T. Zillger, J. Rühling, A. Hübler,

and N. S. Sariciftci, "4% Efficient Polymer Solar Cells on Paper Substrates," *J Phys Chem C*, vol. 118, no. 30, pp. 16813–16817, 2014.

All publications
***** indicates over 100 citations

31. H. Sun, L. Sun, T. Sugiura, **M. S. White**, P. Stadler, N. S. Sariciftci, A. Masuhara, and T. Yoshida, "Microwave-Assisted Hydrothermal Synthesis of Structure-Controlled ZnO Nanocrystals and Their Properties in Dye-sensitized Solar Cells" *Electrochemistry* (2017) ELECTROCHEMISTRY-D-16-00118R1

30. Y. Tsuda, H. Sun, L. Sun, S. Okada, A. Masuhara, P. Stadler, N. S. Sariciftci, **M. S. White**, and T. Yoshida, "Electrochemical Self-Assembly of CuSCN-DAST Hybrid Thin Films" *Chemical Monthly* (2017). doi: 10.1007/s00706-017-1929-5

29. A. Toba, J. Matsui, K.-I. Nakayama, T. Yoshida, C. Yumusak, P. Stadler, M. C. Sharber, **M. S. White**, N. S. Sariciftci, and A. Masuhara, "Organic Microbox Prepared by Self-Assembly of a Charge-Transfer Dye" *Chemistry Letters* (2017): cl.161191. doi:10.1246/cl.161191

28. C. Cobet, J. Gąsiorowski, R. Menon, K. Hingerl, S. Schlager, **M. S. White**, H. Neugebauer, N. S. Sariciftci, and P. Stadler, "Influence of molecular designs on polaronic and vibrational transitions in a conjugated push-pull copolymer" *Scientific Reports,* vol. 6, 2016

27. G. Adam, M. Kaltenbrunner, E. D. Głowacki, D. H. Apaydin, **M. S. White**, H. Heilbrunner, S. Tombe, P. Stadler, B. Ernecker, C. W. Klampfl, N. S. Sariciftci, and M. C. Scharber, "Solution processed perovskite solar cells using highly conductive PEDOT:PSS interfacial layer" *Solar Energy Materials and Solar Cells,* vol. 157, pp. 318-325, 2016

26. C. Enengl, S. Enengl, M. Havlicek, P. Stadler, E. D. Głowacki, M. C. Scharber, **M. S. White**, K. Hingerl, E. Ehrenfreund, H. Neugebauer, and N. S. Sariciftci, "The Role of Heteroatoms Leading to Hydrogen Bonds in View of Extended Chemical Stability of Organic Semiconductors." *Adv. Funct. Mater.,* vol. 25, pp. 6679-6688, 2015

25.* M. Kaltenbrunner, G. Adam, E. D. Głowacki, M. Drack, R. Schwödiauer, L. Leonat, D. H. Apaydin, H. Groiss, M. C. Scharber, **M. S. White**, N. S. Sariciftci, and S. Bauer, "Flexible high power-per-weight perovskite solar cells with chromium oxide-metal contacts for improved stability in air." *Nat Mater*, vol. 14, pp. 1032-1039, 2015.

24. E. D. Głowacki, H. Coskun, M. A. Blood-Forsythe, U. Monkowius, L. Leonat, M. Grzybowski, D. Gryko, **M. S. White**, A. Aspuru-Guzik, and N. S. Sariciftci, "Hydrogen-Bonded Diketopyrrolopyrrole (DPP) Pigments as Organic Semiconductors," *Organic Electronics*, vol. 15, no. 12, pp. 3521-3528, 2014.

23. O. A. Efremova, K. A. Brylev, O. Kozlova, **M. S. White**, M. A. Shestopalov, N. Kitamura, Y. V. Mironov, S. Bauer, and A. J. Sutherland, "Polymerisable octahedral rhenium cluster complexes as precursors for photo/ electroluminescent polymers," *J. Mater. Chem. C*, vol. 2, pp. 8630–8638, 2014.

22. E. Portenkirchner, D. Apaydin, G. Aufischer, M. Havlicek, **M. S. White**, M. C. Scharber, and N. S. Sariciftci, "Photoinduced Energy Transfer from Poly(N-vinylcarbazole) to Tricarbonylchloro-(2,2′-bipyridyl)rhenium(I)," *ChemPhysChem*, p. Preprint, 2014.

21. G. Adam, T. Yohannes, **M. S. White**, A. Montaigne, C. Ulbricht, E. Birckner, S. Rathgeber, C. Kästner, H. Hoppe, N. S. Sariciftci, and D. A. M. Egbe, "Effect of Varying Thiophene Units on Charge-Transport and Photovoltaic Properties of Poly(phenylene ethynylene)- alt-poly(phenylene vinylene) Polymers," *Macromol. Chem. Phys.*, vol. 215, no. 15, pp. 1473–1484, 2014.

20. K. Ichinose, T. Mizuno, **M. S. White**, and T. Yoshida, "Control of Nanostructure and Crystallographic Orientation in Electrodeposited ZnO Thin Films via Structure Directing

Agents," *J Electrochem Soc*, vol. 161, no. 5, pp. D195–D201, 2014.

19. Y. Ogawa, **M. S. White**, L. Sun, M. C. Scharber, N. S. Sariciftci, and T. Yoshida, "Substrate-Oriented Nanorod Scaffolds in Polymer-Fullerene Bulk Heterojunction Solar Cells," *ChemPhysChem*, vol. 15, no. 6, pp. 1070–1075, 2014.

18. T. Iwamoto, Y. Ogawa, L. Sun, **M. S. White**, E. D. Glowacki, M. C. Scharber, N. S. Sariciftci, K. Manseki, T. Sugiura, and T. Yoshida, "Electrochemical Self-Assembly of Nanostructured CuSCN/Rhodamine B Hybrid Thin Film and Its Dye-Sensitized Photocathodic Properties," *J Phys Chem C*, vol. 118, no. 30, pp. 16581–16590, 2014.

17. Y. Udum, P. Denk, G. Adam, D. H. Apaydin, A. Nevosad, C. Teichert, **M. S. White**, N. S. Sariciftci, and M. C. Scharber, "Inverted bulk-heterojunction solar cell with cross-linked hole-blocking layer," *Organic Electronics*, vol. 15, no. 5, pp. 997–1001, 2014.

16. L. Leonat, **M. S. White**, E. D. Głowacki, M. C. Scharber, T. Zillger, J. Rühling, A. Hübler, and N. S. Sariciftci, "4% Efficient Polymer Solar Cells on Paper Substrates," *J Phys Chem C*, vol. 118, no. 30, pp. 16813–16817, 2014.

15. E. D. Głowacki, M. Irimia-Vladu, M. Kaltenbrunner, J. Gasiorowski, **M. S. White**, U. Monkowius, G. Romanazzi, G. P. Suranna, P. Mastrorilli, T. Sekitani, S. Bauer, T. Someya, L. Torsi, and N. S. Sariciftci, "Hydrogen-Bonded Semiconducting Pigments for Air-Stable Field-Effect Transistors," *Adv. Mater.*, vol. 25, no. 11, pp. 1563–1569, 2013.

14.* **M. S. White**, M. Kaltenbrunner, E. D. Głowacki, K. Gutnichenko, G. Kettlgruber, I. Graz, S. Aazou, C. Ulbricht, D. A. Egbe, and M. C. Miron, "Ultrathin, highly flexible and stretchable PLEDs," *Nature Photon*, vol. 7, no. 10, pp. 811–816, 2013.

13. S. Aazou, A. Ibral, **M. S. White**, M. Kaltenbrunner, E. D. Glowacki, D. A. Egbe, N. S. Sariciftci, and E. M. Assaid, "Organic Bulk Heterojunction Solar Cells Based on P3HT and Anthracene-Containing PPE-PPV: Fabrication, Characterization and Modeling," *Journal of Optoelectronics and Advanced Materials*, vol. 13, no. 5, pp. 395–404, 2013.

12. M. Kaltenbrunner, **M. S. White**, T. Sekitani, N. S. Sariciftci, S. Bauer, and T. Someya, "Breakthroughs in Photonics 2012: Large-Area Ultrathin Photonics," *IEEE Photonics J.*, vol. 5, no. 2, pp. 0700805–0700805, 2013.

11.* M. Kaltenbrunner, **M. S. White**, E. D. Glowacki, T. Sekitani, T. Someya, N. S. Sariciftci, and S. Bauer, "Ultrathin and lightweight organic solar cells with high flexibility," *Nat Commun*, vol. 3, p. 770, 2012.

10. **M. S. White**, D. C. Olson, N. Kopidakis, A. M. Nardes, D. S. Ginley, and J. J. Berry, "Control of charge separation by electric field manipulation in polymer-oxide hybrid organic photovoltaic bilayer devices," presented at the Physica Status Solidi a-Applications and Materials Science, vol. 207, no. 5, pp. 1257–1265, 2010.

9.* M. T. Lloyd, D. C. Olson, P. Lu, E. Fang, D. L. Moore, **M. S. White**, M. O. Reese, D. S. Ginley, and J. W. P. Hsu, "Impact of contact evolution on the shelf life of organic solar cells," *J. Mater. Chem.*, vol. 19, no. 41, pp. 7638–7642, 2009.

8.* M. O. Reese, **M. S. White**, G. Rumbles, D. S. Ginley, and S. E. Shaheen, "Optimal negative electrodes for poly(3-hexylthiophene): [6,6]-phenyl C61-butyric acid methyl ester bulk heterojunction photovoltaic devices," *Appl. Phys. Lett.*, vol. 92, no. 5, p. 053307, 2008.

7.* D. C. Olson, Y.-J. Lee, **M. S. White**, N. Kopidakis, S. E. Shaheen, D. S. Ginley, J. A. Voigt, and J. W. P. Hsu, "Effect of ZnO processing on the pliotovoltage of ZnO/poly(3-hexylthiophene) solar cells," *J Phys Chem C*, vol. 112, no. 26, pp. 9544–9547, 2008.

6. C. G. Allen, D. S. Ginley, D. C. Olson, D. T. Gillaspie, **M. S. White**, R. T. Collins, T. E. furtak, and D. J. Baker, "Oxtadexyltriethoxysilane Surface Modification of Zinc Oxide," *MRS Proceedings*, vol. Spring, p. 6, 2008.

5.* M. O. Reese, A. J. Morfa, **M. S. White**, N. Kopidakis, S. E. Shaheen, G. Rumbles, and D. S. Ginley, "Pathways for the degradation of organic photovoltaic P3HT:PCBM based devices," *Solar Energy Materials and Solar Cells*, vol. 92, no. 7, pp. 746–752, 2008.

4.* D. C. Olson, Y.-J. Lee, **M. S. White**, N. Kopidakis, S. E. Shaheen, D. S. Ginley, J. A. Voigt, and J. W. P. Hsu, "Effect of polymer processing on the performance of poly(3-hexylthiophene)/ZnO nanorod photovoltaic devices," *J Phys Chem C*, vol. 111, no. 44, pp. 16640–16645, 2007.

3.* D. C. Olson, S. E. Shaheen, **M. S. White**, W. J. Mitchell, M. F. A. M. Van Hest, R. T. Collins, and D. S. Ginley, "Band-Offset Engineering for Enhanced Open-Circuit Voltage in Polymer–Oxide Hybrid Solar Cells," *Adv. Funct. Mater.*, vol. 17, no. 2, pp. 264–269, 2007.

2. S. E. Shaheen, **M. S. White**, D. C. Olson, N. Kopidakis, and D. S. Ginley, "Inverted bulk-heterojunction plastic solar cells," *SPIE Newsroom*, vol. 24, 2007.

1.* **M. S. White**, D. C. Olson, S. E. Shaheen, N. Kopidakis, and D. S. Ginley, "Inverted bulk-heterojunction organic photovoltaic device using a solution-derived ZnO underlayer," *Appl. Phys. Lett.*, vol. 89, no. 14, p. 143517, 2006.

Book Chapters

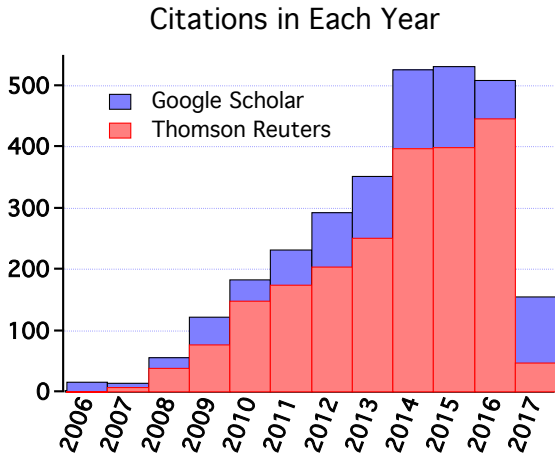
2. **M. S. White** and N. S. Sariciftci, "Nanostructured organic bulk heterojunction solar cells," in *Nanotechnology. Volume 7: Light and Energy*, John Wiley and Sons, ed. K. Kalyanasundaram and M. Graetzel, 2014

1. **M. S. White** and N. S. Sariciftci, "Semiconducting polymer based bulk heterojunction solar cells," in *Polymers for energy storage and conversion*, John Wiley and Sons, ed. Vikas Mittal, 2013.

Bibliometrics

Google Scholar: Matthew Schuette White
ResearcherID: White, Matthew S (B-3405-2013)
ORCID: 0000-0001-6719-790X

Source	Thomson Reuters	Google Scholar
Times cited	2204	3006
h-index	14	15
Most cited	506	738



CURRICULUM VITAE

Personal Data

Name	Junru Wu
Citizenship:	USA
Address:	Dept. of Physics Cook Physical Science Bldg. University of Vermont Burlington VT 05405 (802)656-8357 (O) (802)862-7791 (R)
E-mail address:	jwu@uvm.edu

Education

UCLA, Ph.D. (Experimental Physics), June 1985
UCLA, M.S. (Physics), December 1981

Professional Experience

2016-present	Board member of the Journal of Nanopaticles & Nanotechnology
2015-present	Board member of the Journal of Advances in Internet of Things (AIT).
2008-present	Co-founder of Microgen Systems Inc.
1998-2008	Chair of Department of Physics
1996-present	Professor, Department of Physics, University of Vermont, (primary position)
1996-present	Professor, Department of Mechanical Engineering, University of Vermont, (secondary position)
1994-1996	Associate Professor, Department of Mechanical Engineering, University of Vermont, (secondary position)
1994-present	Consultant in Ultrasound Physics, Surgical Associates, University Health Center, University of Vermont

1993-1996	Associate Professor, Department of Physics, University of Vermont, Burlington, VT
1987-1993	Assistant Professor, Department of Physics, University of Vermont, Burlington, VT
1986-1987	Adjunct Assistant Professor and Research Associate, Department of Physics, UCLA
1985-1986:	Lecturer and Post-doctoral Research Associate with Professors Isadore Rudnick and John Wheatley, Department of Physics, UCLA
1983-1985:	Research Assistant for Professor I. Rudnick, Department of Physics, UCLA
1980-1985:	Teaching Assistant, Department of Physics, UCLA

Professional Affiliations

IEEE, The American Physical Society, The Acoustic Society of America, American Institute of Ultrasound in Medicine.

Awards and Honors

University of Vermont Inventors Hall of Fame Award, 2015

Member of Sigma Xi society.

Outstanding Teaching Assistant Award, UCLA, 1983.

National Scientific Progress Award (China), First Prize, 1986.

Member of the Technical Committee on Physical Acoustics, The Acoustical Society of America (1990-1996).

Fellow of the Acoustical Society of America (1991-present).

Fellow of the American Institute of Ultrasound in Medicine (1996-present).

Bioeffects Committee, American Institute of Ultrasound in Medicine (1995-1998).

Technical Standard Committee, American Institute of Ultrasound in Medicine (1998-2001).

Biomedical Ultrasound Committee, Acoustical Society of America (2000-2003).

Elected Full Member of Vermont Academy of Science and Engineering, 2001.

Listed in 2000 Outstanding Intellectuals of the 21 Century (2004).

Listed in Who's Who in the World (2006).

Listed in Academic Keys Who's Who in Engineering Education (2006)

Scientific Journals International, Editorial Board Member (2006-present)

NIH "Development and Implementation of Innovative Ultrasound Therapy Technologies" Review Panel (June, 2008).

Theses and Dissertations Directed

Honors Thesis, "Experimental studies of a quasi two-dimensional nonpropagating hydrodynamic soliton," Erik Winkler, Fall 1988 - Spring 1989.

Honors Thesis, "Temperature elevation generated by a focused ultrasonic beam at a tissue-bone interface," Andrew J. Winkler, Fall 1991 - Spring 1992.

Master's Thesis, "Ultrasound Heating in a Tissue-Bone Phantom," Timothy P. O'Neill, Spring 1992-Fall 1993.

Master's Thesis, "Accuracy of Volume Flow and Peak Velocity Measurements Made with Commercial Doppler System," Andrew J. Winkler, Fall 1993 - Spring 1995.

Master's Thesis, "Temperature Rise Generated by Diagnostic Ultrasound in Tissue and Tissue/Bone Phantoms," Frances S. M. Cubberley, Spring, 1996.

Master's Thesis, "The Design and Calibration of an Instrument for Microscopic Observation of the Effects of Ultrasound," Gerard Gormley, Spring, 1997.

Master's Thesis, "Lamb-Wave Ultrasonic Sensors," Daniel Fischer, Spring, 1998.

Mater's Thesis, "Effects of Ultrasound on Skin," John Chappelow, Fall, 1998.

Master's Thesis, "Biological Effects of Ultrasound Enhanced by Contrast Agents," Mark Ward, Spring, 2000.

Master's Thesis, "Cell Transfection Induced by Ultrasound in the Presence of Encapsulated Microbubbles," Jason Pepe, Summer, 2003.

Ph. D Dissertation, “Nanomechanics and polymer Physics,” Chris Layman, May, 2002-2007.

Ph. D Dissertation, “X-ray investigation of semi-crystalline polymer fiber during deformation” WenJie Wang, 2004-2009.

Ph. D Dissertation, “Applications of acoustic techniques to targeting drug delivery and dust removal relevant to NASA projects” Di Chen, 2005-2010.

Ph. D Dissertation, “Development of a MEMS-based Piezoelectric Vibrational Energy Harvester for Wireless Sensor Network Applications” Robert Andosca, 2007-2012.

Ph. D thesis, “Spatially and temporarily periodic potentials” Owen Myers, 2011-2015.

Professional Activities

Reviewed "Introductory College Physics," for McGraw-Hill Book Company, 1987.

Served as a reviewer for The Physical Review Letters, Nature, The Journal of Acoustical Society of America, and Ultrasound in Medicine and Biology.

Served as a reviewer for proposals submitted to NSF and DOE.

Served as a reviewer for proposals submitted to The Wellcome Trust, London, England.

Served as a member of a proposal review panel for NSF.

Serve as a reviewer for proposal submitted to Swiss National Science Foundation.

Organized and chaired a special session "Nonlinear Physical System" at 123rd Meeting of the Acoustical Society of America, Salt Lake City, May 1992.

Chaired a special session "Medical Ultrasound I -- Transduction and Propagation" at 16th International Congress on Acoustics, Seattle, June 1998.

Organized and chair a special session "Ultrasound-mediated drug delivery and gene transfection" at 144th Meeting of the Acoustical Society of America, Cancun Mexico, December 2002.

Chair symposium in celebration of Dr. Wesley Nyborg’s fiftieth year in the Department of Physics, October 2009.

Chair memorial session for Dr. RongJui Wei, Seattle, Acoustic Society of America, 2011.

Chair memorial session for Dr. Wesley Nyborg, Kansus City, Acoustic Society of America, Kansas City, 2012.

University Service

University of Vermont College of Medicine Dean Search Committee (1990-91).

Materials Science Program Steering Committee (1991-1998).

Senate Research and Scholarship Committee (1993-1997).

Representative to the Senate (1995 -1997).

Department of Physics Review Committee (1996-1997).

APS/NES Fall Meeting, Co-chair, 1996.

Faculty Search Committee, Dept. of Physics, Chair, (1997-1998).

University of Vermont College of Engineering and Mathematics, Dean Search committee, Vice Chair, (1998-1999).

Chair of Department of Chemistry Chairperson Search Committee (2001).

Chair of Department of Mechanical Engineering Chairperson Search Committee (2003-2004).

Department of Chemistry Review Committee (2007-2008).

School of Engineering, Faculty Search Committee, (2009-2010).

School of Engineering, Faculty Search Committee, (2011-2012).

School of Engineering chair professor search committee, Chair (2012).

Commissioner of President's Commission on racial diversity. (2011-2013)

School of Engineering, Faculty Search Committee, (2012-2013).

Patent

(1) Implant debris detection, United States patent, US6413215 B1, July 2, 2002, Co-Inventors: Eric Weissman, Elmer Dickens, Jr.

(2) US patent N0. 8062587, "Apparatus and Method for Ultrasound Treatment of Aquatic Organisms," Nov. 22, 2011. http://www.faqs.org/patents/app/20080257830#ixzz0lI2y21KFPiezoelectric Co-Inventors: Junru Wu and Meiyin Wu, Agents: HOFFMANN & BARON, LLP Assignees: The Research Foundation of State University of New York. Origin: SYOSSET, NY, US, IPC8 Class: AC02F136FI , USPC Class: 210748.

(3) US patent No. 7799233, "Apparatus and Method for Ultrasound Treatment of Aquatic Organisms." Co-Inventors: Meiyin Wu and Junru Wu. Sept 21, 2010.

(4) US patent No. 9174189, "Apparatus and Method for Ultrasound Treatment for ballast water management." Co-Inventors: Meiyin Wu and Junru Wu. Nov. 3, 2015.

(5) U.S. Patent No. 8,080,920, "Piezoelectric vibrational energy harvesting systems incorporating parametric bending mode energy harvesting", Inventors: R.G. Andosca and J. Wu; Assigned: The University of Vermont and State Agricultural College; Awarded December 11, 2011.

(6) U.S. Patent, Aeroacoustic Duster, J. Marshall, D. Hitt, J. Wu, N. Vachon, D. Chen, U.S. Patent 08695156 (2014).

(7) U.S. Patent, Serial No. 14290425, Internal vibration impulse broadband excitation energy harvest systems and methods, May 29, 2014.

Research Grants Received

Characterization and modeling of biofilm development by a model multi-species ISS bacterial community, NASA EPSCoR, $744,990, 9/1/2016 to 8/31/2018, Award Number: 31134, project #: 032598.

Determination of piezoelectric properties in selected quasicrystals, Suneidon Cooperation, $104,631, June 1, 2016 to May 31, 2018.

"Treatment of the fatty liver disease of mice using sonoporation" UVM FISAR grant, $39,427, Jan.1, 2016-July, 1, 2017, Wu and Ricon Co-PI.

"Biofilm Mitigation by Ultrasound-Enhanced Targeted Liposome Treatment in Terrestrial- and Micro-Gravity" NASA EPSCoR, $744,990, Science PI. Grant Number: NNX13AD40A; 12/26/2012 to 12/25-2016.

Vermont space consortium, 2012 GRA Competition, Sept 1, 2012 to Aug. 30, 2013, $27,500.

Vermont space consortium, 2011 GRA Competition, Sept 1, 2011 to Aug. 30, 2012, $27,500.

Connective tissue and nervous system mechanisms of CAM therapies for low back pain, Co-PI, Helene Langivin PI, NIH, 2011-2016, $1,250,000.

Ultrasound Technology for Great Lakes Ballast Water Treatment, DOI Prime Award No. 30181AGO98, Co-PI, $673,530, Oct 2010 – Sept 2014.

Advanced dust suppression technology for Martian and lunar habitation, NASA EPSCoR, $749,999, Lakin, W. PI, Wu, J. Co PI. (2008-2011)

Piezoelectric Vibrational Energy Harvester and *Energy Scavenger for Wireless Sensor Networks*, Advanced Sensors and Controls for Buildings and Industrial Applications, NYSERDA (New York State Energy Research and Development Authority) Award, $300,000, 2008.

Vibrational Energy Harvesting Devices, SBIR, VT EPSCoR, 2007, Robert Adosca and J. Wu, $10,000.

Vibrational Energy Harvesting Devices, UVM Innovationa Fund, 2008, Robert Adosca and J. Wu, $100,000.

Nano-Energy Harvester Array, Infononics Technology Center, 2007-2008, $57.5K, PI.

Development of Composite Materials, EPA, subcontract from UMASS (2005-2008), $208 K, PI, Dan Savin is Co-PI.

Soft Tissue Biomechanical Behavior During Acupuncture in Low Back Pain, NIH, 2006-2011, CoPI, $1,250,000 (R01 AT003479).

Feasibility Study of Ultrasound Application for Water Chesnut (Trpa natams L,) Management in Lake Champlain, NOAA, 2004-2007, PI, $61,563.

Acupuncture Mechanism: Mechanotransduction model, NIH, 2002 to 2006, $ 1,250,000, Collaborator.

Acquisition of Micro-Scale Fabrication Equipment, NSF, 2001-2003, C0-PI, $240,771.

Mechanics and Enzymology of a Single Myosin Motor, NIH R01 HL68142, 2001-2006, Co-PI, $1 M.

Investigation of the Effects of Acupuncture Needling on Connective Tissue using Ultrasound, NIH, 2000-2002, Co-PI, $374,950.

Experimental Determination of Sonic Effects Generated by Electrical Tooth Brushes, Gillette Co. 1999-2002, $32,448.

Detection of Vascular Stents Using Ultrasound, BFGoodrich, 1999-2002, $67,252.

Feasibility Study on Transdermal Drug delivery Enhanced by Ultrasound, Lumar Ltd., 1999, $15,000.

Bioeffects of Ultrasound Associated with Contrast Agents, Mallinckrodt, Inc., 1998-1999, $64,279.

Shear Wave Elasticity Imaging System, University of Vermont Research Advisory Council, 1997, $14,913.

"Determination of Fuel Density Using FT-IR," BFGoodrich, 7/1/1997-9/31/97, $22,750

"Development of a single molecule Laser optical trap/Fluorescence Detection System," 9/1/97-8/31/2000, Co-PI, NSF, $353,000

"Molecular Mechanics of Mutant Smooth Muscle Myosin," NIH, Co-PI, 7/1, 1996-6/30, 2001, $856,000.

Two "7702A Ultrasound imaging systems," Donations from Hewlett-Packard Co. combined value $312,000, Sept. 1996.

"Development of a modern undergraduate laboratory in wave-related phenomena," NSF, 7/1/95-6/30/97, $58,719.

"Smooth Muscle Cross-Bridge: Molecular Mechanics," NIH, CO-PI, 7/1/93-6/30/98, $1,171,142.

"Smooth muscle crossbridge interactions: a motility assay," NIH, co-principal investigator, 7/1/90 - 6/30/95, $802,903.

"Local Heating by a Single Ultrasound Transducer," Vermont Regional Cancer Center, 7/1/89 - 6/30/90, $5,476.00.

"Low Loss Solid Acoustic Waveguide and Acoustic Methods of Detecting Ice Formation," Simmonds Precision, 6/1/90 - 12/1/90, $10,000.

"A hot-wire/hot-film anemometer," University of Vermont Research Advisory Council, co-principal investigator (1990), $9,870.

"Laser generating ultrasound," Simmonds Precision, 1/1/91 - 12/1/91, $20,000.

"Development of Fiber Optical Ultrasound Pulse Detecting Technique," Simmonds Precision, 1/1/92 - 12/31/92, $25,000.

"Distributed Defects Detection System Using Acoustic Waveguide," Simmonds Precision, 1/1/93- 12/31/93, $15,000.

"Ultrasonic Heating in Tissue-Like Materials," Hewlett-Packard Imaging Systems, 3/1/93-8/28/94, $25,000

"NSF equipment Funding," NSF MSS-9212885, 2/1/93-5/31/94, $22,990.

"Ultrasound Enhanced Anti-Cancer Drug Action," American Cancer Society - Vermont Division, Sept.1, 1993 - Aug. 31, 1994, $6,000

"Advanced Material Science Cluster," NSF and EPSCoR/Vermont," Lamb Wave Microsensor Development Project," 1994-1998, $200,000.

"Lamb Wave Microsensor Development," Co-PI, Pre-SBIR Vermont EPSCoR, 1994, $5,000.

"Non-contact power/interrogation system for embedded acoustic structure integrity monitoring," Simmonds Precision, 1/1/1994-6/30/95, $20,000.

"Near-field Scanning Optical Microscope," University of Vermont Research Advisory Council, 1995, $7,602.

"An Experimental Search for Localized States in Polymers and Biomedical Systems," University of Vermont Institutional Grant, #PSCI 88-2, 1/1/88 - 12/31/88, $8,230.

"Searching for Two-dimensional Solitons in a Fluid," NSF and EPSCoR/Vermont, Proj. 15, 7/1/88 - 9/30/91, $101,427.

Research Publications – Books and Book Chapters (Invited)

J. Wu, Solitons, McGraw-Hill Year Book of Encyclopedia of Science and Technology, p. 415 (McGraw Hill, New York, NY, 1986).

J. Wu, *Discovery of a Non-Propagating Hydrodynamic Soliton, Proceedings of the International School of Physics*, "Enrico Fermi," Course XCIII, "Frontiers in Physical Acoustics," p. 200 (North-Holland, 1986).

J. Wu and G. Du, *Calculations of Temperature Elevation in Tissues Generated by Finite AmplitudeTonebursts of Ultrasound, Frontiers of Nonlinear Acoustics*, Edited by M. F. Hamilton and D. T. Blackstock, 12th ISNA, 451-456 (Elsevier Applied Science, London, 1990).

Wesley L. Nyborg and J. Wu, *Relevant Field Parameter with Rationale, in Ultrasonic Exposimetry*, M. C. Ziskin and P. A. Lewin eds., 85-112 (CRC Press, Inc., Florida, 1992).

J. Wu, *Determination of Velocity and Attenuation Using Broadband Pulse Technique, in Acoustic Imaging*, V. 23, Sidney Lees and Leonard A. Ferrari Eds., 137-143 (Plenum Press, New York, 1997).

W.B. Spillman Jr., D.R. Huston and J. Wu, *Fiber Optic Sensors for Seismic Monitoring*, in "Earthquake Source Asymmetry, Structural Media and Rotation Effects" edited by R. Teisseyre, M. Takeo and E. Majewski, 521-546 (Springer-Verlag, Berlin 2006).

J. Wu, Editor and author, *Emerging therapeutic ultrasound,* World Scientific Publishing Co., Singapore, August, 2006.

J. Wu, " Sonoporation Sonoporation: Concept, mechanisms and application to cancer treatment", in Imaged-guided ultrasound therapy: physics and chemical applications, Eds: ter Haar, G., and Wu, F. CRC Press, New York (2017).

J. Wu, "Handbook of contemporary acoustics and its applications" World Scientific Publishing Co. (2016)

Research Publications - Refereed Journal Articles

1. R. J. Wei and J. Wu, *Absorption of Sound in Water Fog*, J. Acous. Soc. Am. **70**, 1213 (1981).

2. J. Wu and I. Rudnick, *An upper Division Student Laboratory Experiment which Measures the Velocity Dispersion and Nonlinear Properties of Gravitational Surface Wave in Water*, Am. J. Phys. **52** (11), 1008 (1984).

3. J. Wu, R. Keolian and I. Rudnick, *Observation of a Nonpropagating Hydrodynamic Soliton*, Phys. Rev. Lett. **52**, 1421 (1984).

4. J. Wu, A. Larraza, and I. Rudnick, *Measurements of Nonlinear Resonant Curves of a Rectangular Surface Water Wave Resonator*, Acta Phys. Sinica **34**, 767 (1985).

5. J. Wu and I. Rudnick, *Amplitude Dependent Properties of a Hydrodynamic Soliton,* Phys. Rev. Lett. **55**, 204 (1985).

6. J. Wu and I. Rudnick, *Measurements of Nonlinear Tuning Curves of Helmholtz Resonators,* J. Acous. Soc. Am. **80**, 1419 (1986).

7. J. Wu, J. Wheatley, S. Putterman and I. Rudnick, *Observation of Envelope Solitons in Solids*, Phys. Rev. Lett. **59**, 2744 (1987).

8. J. Wu, E. Guyon, A. Palevski, S. Roux and I. Rudnick, *Flexion Modes of a Thin Plate Near Percolation Threshold*, Comptes Rendus de Academie des Sciences, Serie II, p. 323 (1987).

9. J. Wu and W. L. Nyborg, *Measurements of Peak Frequency of Transmission Loss to Ultrasound Through Two-Dimensional Trapped Bubble Versus the Amplitude of Incident Wave,* J. Acous. Soc. Am. **86**, 2250 (1989).

10. J. Wu, *Are Sound Waves Isothermal or Adiabatic?* Am. J. Phys. **58**, 694 (1990).

11. J. Wu and W. L. Nyborg, *Measurement of Frequency Spectra of Transmission Coefficients to Ultrasound Through Trapped Microbubbles,* Ultrasonics **28**, 115 (1990).

12. J. Wu, G. Du, S. S. Work, and D. W. Warshaw, *Acoustic Radiation Pressure on a Rigid Cylinder, an Analytical Theory and Experiments,* J. Acous. Soc. Am. **87**, 581 (1990).

13. J. Wu and G. Du, *Temperature Elevation Generated by a Focused Gaussian Beam of Ultrasound,* Ultrasound in Med. & Biol. **16**, 489 (1990).

14. E. Winkler and J. Wu, *An Experiment to Study Localized Excitations – Nonpropagating Hydrodynamic Solitons,* Am. J. Phys. **58** (11), 1100 (1990).

15. J. Wu and G. Du, *Acoustic Radiation Force on a Small Compressible Sphere in a Focused Beam*, J. Acous. Soc. Am. **87**, 997 (1990).

16. G. Du and J. Wu, *Comparison Between Two Approaches for Solving Nonlinear Radiations from a Bubble in a Liquid*," J. Acoust. Soc. Am. **87**, 1965 (1990).

17. J. Wu and G. Du, *Temperature Elevation Generated by a focused Gaussian Ultrasonic Beam at Tissue - Bone Interface,* J. Acous. Soc. Am. **87**, 2748 (1990).

18. J. Wu and G. Du, *Temperature Elevation in Tissues Generated by Finite Amplitude Tonebursts of Ultrasound,* J. Acous. Soc. Am. **88**, 1562 (1990).

19. G. Du and J. Wu, *An Ultrasonic Gaussian Transducer with a Curved back-electrode,* J. Acous. Soc. Am. **89**, 1443 (1991).

20. J. Wu and Z. Zhu, *Measurements of the Effective Nonlinear Parameter B/A of Water Containing Trapped Cylindrical Bubbles*, J. Acous. Soc. Am. **89**, 2634-2639 (1991).

21. J. Wu, *Acoustical Tweezers*, J. Acous. Soc. Am. **89**, 2140-2143 (1991).

22. J. Wu and Z. Zhu, *The Propagation of Lamb Waves in a Plate Bordered with Layers of a Liquid*, J. Acous. Soc. Am. **91**, 861-867 (1992).

23. J. Wu and W. L. Nyborg, *Temperature Rise Generated by a Focused Gaussian Beam in a Two-Layer Medium*, Ultrasound in Med. & Biol. **18**, 292-302(1992).

24. J. Wu, J. D. Chase, Z. Zhu, and T. P. Hozapfel, *Temperature Rise in Tissue-Mimicking Material Generated by an Operating Ultrasonic Transducer*, Ultrasound in Med. & Biol. **18**, 495-512 (1992).

25. J. Wu and G. Du, *Acoustic Streaming Generated by a Focused Gaussian Beam and Finite Amplitude of Tonebursts*, Ultrasound in Med. & Biol. **19**, 167-176 (1993).

26. J. Wu and G. Du, *Comments on Cooperative Radiation and Scattering of Acoustic Waves by Gas Bubbles in Liquids*, J. Acoust. Soc. Am. **94**, 2446-2447 (1993).

27. H. Chen, R. Banerjee and J. Wu, *Strengths of Thin Films Derived From Whey Proteins*, Am. Soc. Agric. Engen. 93-6528, (1993).

28. J. Wu, A. J. Winkler and T. P. O'Neill, *Effect of Acoustic Streaming on Ultrasonic Heating*, Ultrasound in Med. & Biol. **20**, 195-201(1994).

29. T. P. O'Neill, A. J. Winkler, and J. Wu, *Ultrasound Heating in a Tissue-Bone Phantom*, Ultrasound in Med. & Biol. **20**, 579-588 (1994).

30. M. Oksanen and J. Wu, *Prediction of the Temporal Shape of an Ultrasonic Pulse in a Photoacoustic Sensing Application*, Ultrasonics **32**, 43-46 (1994).

31. W. L. Nyborg and J. Wu, *Solution of the Linear Bioheat Transfer Equation*, Phys. Med. & Biol. **39**, 924-926 (1994).

32. Z. Zhu and J. Wu, *The Propagation of Lamb Waves in a Plate Bordered with a Viscous Liquid*, J. Acoust. Soc. Am. **98**, 1057-1064 (1995).

33. J. Wu and W. B. Spillman, Jr., *Unidirectional Acoustic Waveguide System for Defect Detection in Structures*, Smart Materials and Structures **4**, 62-65 (1995).

34. J. Wu and Z. Zhu, *A Perturbation Analysis of Lamb-Wave Sensors*, Ultrasonics 213-219 (1995).

35. J. Wu, Z. Zhu, and G. Du, *Nonlinear Behavior of a Liquid Containing Uniform Bubbles: Comparison Between Theory and Experiments*, Ultrasound in Med. & Biol. **21**, 545-552 (1995).

36. A. J. Winkler, J. Wu, T. Case, and M. A. Ricci, *An Experimental Study of the Accuracy of Volume Flow Measurements Using Commercial Ultrasound Systems*, the Journal of Vascular Technology **19**, 175-180 (1995).

37. A. J. Winkler, and J. Wu, *Correction of Intrinsic Spectral Broadening Errors in Doppler Peak Velocity Measurements Made with Phased Sector and Linear Array Transducers*, Ultrasound in Med. & Biol. **21**, 1029-1035 (1995).

38. J. Wu, *Calculation of Acoustics Radiation Force Generated by Focused Beams Using the Ray Acoustics Approach*, J. Acoust. Soc. Am. **97**, 2747-2750 (1995).

39. P. VanBuren, W. H. Guilford, G. Kennedy, J. Wu and D. M. Warshaw, *Smooth Muscle Myosin: A High Force-Generating Molecular Motor*, Biophysical Journal **68**, 256s-259s (1995).

40. J. Wu and Z. Zhu, *An Alternative Approach for Solving Attenuated Leaky Rayleigh Waves*, J. Acoust. Soc. Am. **97**, 3191-3193 (1995).

41. J. Wu, F. Cubberley, G. Gormley and T. L. Szabo, *Temperature Rise Generated by Diagnostic Ultrasound in a Transcranial Phantom*, Ultrasound in Med. & Biol. **21**, 561-568 (1995).

42. Z. Zhu and J. Wu, *A General Dispersion Relation for Lamb-Wave Sensors With Liquid-Layer Loading*, Sensors and Actuators A **49**, 79-84 (1995).

43. J. Wu and Z. Zhu, *Sensitivity of Lamb Wave Sensors in Liquid Sensing*, IEEE Trans. Ultrasonics, Ferroelectrics, and Frequency Control **43**, 71-72 (1996).

44. J. Wu, *Determination of Velocity and Attenuation of Shear Waves Using Ultrasonic Spectroscopy*, J. Acoust. Soc. Am. **99**, 2871-2875 (1996).

45. J. Wu, *Effects of Nonlinear Interaction On Measurements of Frequency Dependent Attenuation Coefficients*, J. Acoust. Soc. Am. **99**, 3380-3384 (1996).

46. J. Wu and G. Du, *Analogy Between the One-Dimensional Acoustic Waveguide and the Electrical Transmission Line*, J. Acoust. Soc. Am. **100**, 3973-3975 (1996).

47. R. Banerjee, H. Chen and J. Wu, *Milk Protein-Based Edible Film Mechanical Strength Changes Due to Ultrasound Process*, J. Food, Sci **61**, 824-828 (1996).

48. D. B. Tata, J. Biglow, J. Wu, T. R. Tritton and F. Dunn, *Ultrasound-Enhanced Hydroxyl Radical Production From Two Clinically Employed Anticancer Drugs, Adriamycin and Mitomycin C*, Ultrasonics Sonochemistry **3**, 39-45 (1996).

49. D. E. Dupuis, W. H. Guilford, J. Wu, and D. M. Warshaw, *Actin Filament Mechanics in the Laser Trap*, J. Muscle Research & Cell Motility **18**, 17-30 (1997).

50. J. Wu and F. Cubberley, *Measurement of Velocity and Attenuation of Shear Waves in Bovine Compact Bone Using Ultrasonic Spectroscopy*, Ultrasound in Med. & Biol. **129**-134 (1997).

51. W. H. Guilford, D. E. Dupuis, G. Kennedy, J. Wu, J. B. Patlak, and D. M. Warshaw, *Smooth and Skeletal Muscle Myosins Produce Similar Unitary Forces and Displacements in Laser Trap*, Biophysical J. **72**, 1006-1021, (1997).

52. M. Oksanen, J. Varis, J. Hietanen and J. Wu, *Quantitative Theory for V-groove Capasitive Transmitting Transducers*, Ultrasonics **35**, 205-211 (1997).

53. J. Wu and G. Du, Streaming *Generated by a Bubble in an Ultrasound Field*, J. Acoust. Soc. Am. **101**, 1899-1907, (1997).

54. J. Wu and J. Tong, *Measurements of Nonlinearity Parameter B/A of Contrast Agents*, Ultrasound in Med. and Biol. **24**, 153-159 (1998).

55. J. Wu, J. Chappelow, J. Yang, and L. Weimann, *Defects Generated in Human Stratum Corneum Specimen by Ultrasound*, Ultrasound in Med. and Biol. **24**, 705-710 (1998).

56. Z. Zhu, J. Wu and G. Du, *Theory of Acoustic Streaming Generated by the Ultrasonic Lamb Waves*, J. Acoust. Soc. Am. **104**, 86-90 (1998).

57. J. Wu and J. Tong, *Experimental Study of Stability of Contrast Agents*, Ultrasound in Med. & Biol. **24**, 257-265 (1998).

58. J. Wu, *Temperature Rise Generated by Ultrasound in the Presence of Contrast Agents*, Ultrasound in Med. & Biol. **24**, 267-274 (1998).

59. M. S. Malghani, J. Yang, and J. Wu, *Generation and Growth of Bilayer Defects Induced by Ultrasound*, J. Acoust. Soc. Am. **103**, 1682-1685 (1998).

60. G. Gormley and J. Wu, *Observation of Acoustic Streaming Near Albunex Spheres*, J. Acoust. Soc. Am. **104**, 3115-3118 (1998).

61. D. Warshaw, E. Hayes, D. Gaffney, A-M. Lauzon, J. Wu, K. Trybus, S. Lowey, C. Berger, *Myosin Conformational States Determined by Single Fluorophore Polarization*, Proc. Natl. Acad. Sci. USA. **95**, 8034-8039 (1998).

62. M. Ward, J. Wu, and J-F Chiu, *Ultrasound-Induced Cell Lysis and* Sonoporation Enhanced by Contrast Agents, J. Acoust. Soc. Am. **105**, 2951-2957 (1999).

63. T. L. Szabo and J. Wu, *A Model for Longitudinal and Shear Wave Propagation in Viscoelastic Media*, J. Acoust. Soc. Am. **107**, 2437-2446 (2000).

64. D. Fischer, W. Varhue, J. Wu, and C. Whiting, *Lamb-Wave Microdevices Fabricated on Monolithic Single Crystal Silicon Wafers*, IEEE Journal of Microelectromechanical Systems, **9**, 88-93 (2000).

65. M. Ward, J. Wu and J-F Chiu, *Experimental Study on Effects of Optison Concentration on Sonoporation in Vitro*, Ultrasound in Med. & Biol **26**, 1169-1175 (2000).

66. W. Chen and J. Wu, *Reflectometry Using Longitudinal, Shear and Rayleigh Waves*, Ultrasonics **38**, 909-913 (2000).

67. S. Ye, J. Wu, and J. Peach, *Ultrasound Shear Wave Imaging for Bone*, Ultrasound in Med. & Biol, **26**, 833-837 (2000).

68. A. Brayman, J. Wu, D. Dalecki, J. Wible, *Mechanical Bioeffects in the Presence of Gas-Carrier Contrast Agents*, in Mechanical Bioeffects from Diagnostic Ultrasound: AIUM Consensus Statements, edited by J. B. Fowlkes and C. K. Holland, J. Ultrasound in Medicine, **19**, 120-142 (2000)

69. J. Wu, *TOFU As A Tissue-Mimicking Material*, Ultrasound in Med. & Biol **27**, 1297-1300 (2001).

70. J. Wu, Joel P. Ross and Jen-Fu Chiu, *Reparable Sonoporation Generated by Microstreaming*, J. Acoust. Soc. Am. 111, 1460-1464 (2002).

71. J. Wu, *Theoretical Study on Shear Stress Generated by Microstreaming Surrounding Contrast Agents Attached to Living Cells*, Ultrasound in Med. & Biol, **28**, 125-129 (2002).

72. L. Weiman and J. Wu, *Transdermal Delivery of Poly-L-Lysine by Sonomacroporartion*, Ultrasound in Med. & Biol, 28, 1216-1223 (2002).

73. H. M. Langevin, D. L. Churchill, J. Wu, J. R. Fox, G. J. Badger, J. A. Yandow and M. H. Krag, *Evidence of Connective Tissue Involvement in Acupuncture*, The FASEB J(Federation of American Societies for Experimental Biology) 16, 872-874, 2002.

74. J. P. Ross, X Cai, J. F. Chiu, J. Yang, J. Wu, *Optical and Atomic Force Microscopic Studies on Sonoporation*, J. Acoust. Soc. Am. 111, 1161-1164, 2002.

75. J. Wu, J. Pepe and William Dewitt III, *Nonlinear Behaviors of Contrast Agents Relative to Diagnostic and Therapeutic Applications*, Ultrasound in Med & Biol. 29, 555-562, 2003**.**

76. James C. Iatridis, Junru Wu, Jason A. Yandow and Helene Langevin, *Subcutaneous Tissue Mechanical Behavior is Linear and Viscoelastic under Uniaxial Tension*, Connective Tissue Research 44, 208-217 (2003).

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141. L. Meng, A. Deng, L. Niu, F. Li, F. Yan, J. Wu, F. Cai, and H. Zheng, A disposable microfluidic device for controlled drug release from thermal-sensitive liposomes by high intensity focused ultrasound, Theranostics 5, 1203-1213. Doi:10.7150/thno. 12295 (2015).

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145. Hang Su, Zhe Li, Yuan Dong, He-Xun Jiang, Hui-Min Zheng, Yong-Hong Du, Junru Wu, Zhi-Biao Wang, Damage Effects on Bacille Calmette-Guérin by Low-Frequency, Low Intensity Ultrasound. J Ultrasound Med, 35:e115–e121 | 0278-4297, 2016.

146. Chen Wang, Feiyan Cai, Fei Li, Long Meng, Jiangyu Li, Junru Wu, Yan Kang and Hairong Zhengb A highly sensitive compact liquid sensor based on slotted phononic crystal plates, Lab on a Chip 00, 1-3, 2016.

147. Adam Green1, Jeffrey S. Marshall, Dong Ma, and Junru Wu, Acoustic Streaming and Thermal Instability of Flow Generated by Ultrasound in a Cylindrical Container, Phys. Fluids 28, 104105 (2016).

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Research Papers - Invited Papers/Seminars/Colloquia

1. Discovery of Solitary, Localized Stationary Water Wave, Meeting of the Acoustical Society of America, San Diego, November, 1983.

2. Discovery of a Non-propagating Hydrodynamic Soliton, Enrico Fermi International School of Physics, Varena, Italy, July, 1984.

3. Non-propagating Hydrodynamic Solitons and their Unique Properties, Institute of Geophysics and Planetary Physics, University of California, San Diego, La Jolla, CA, November, 1983.

4. Non-propagating Hydrodynamic Solitons and their Interaction, Institute for Studies of Nonlinear Dynamics, La Jolla, San Diego, January, 1984.

5. Standing Wave Solitons, Applied Mathematics Department, Princeton University, March, 1984.

6. Recent Experimental Developments in the Study of the Newly Discovered Non-propagating Hydrodynamic Solitons, Institute of Physics and Institute of Acoustics, Chinese Academy of Science, China, June, 1984.

7. Soliton Physics - Its History and New Developments, University of Nanjing, China, May, 1984 and University of Hong Kong, June, 1984.

8. Observations of a Non-propagating Hydrodynamic Soliton: An Example of Experimental Serendipity, Project in Nonlinear Science, Nonlinear Science Workshop, University of California, Los Angeles, October, 1984.

9. Experiments on a Self-Trapping Hydrodynamic Soliton, Institute of Nonlinear Dynamics, University of Texas, Austin, April, 1985.

10. The Principles and Applications of Ultrasound Microscopes Department of Physics, University of Vermont, 1988

11. Experimental Studies On Solitons, Department of Physics, Lehigh University,

1990.

12. Temperature Elevation from Diagnostic Ultrasound
Hewlett Packard, Andover, Massachusetts, 1990.

13. Temperature Rise Generated by Ultrasound
Department of Physics, University of Vermont, 1990.

14. Soliton Physics, Schlumberger - Doll Research, Ridgefield, Connecticut, 1991.

15. Manipulation and Trapping of Particles by Radiation Pressure, Department of Physics, Clarkson University, 1991.

16. Ultrasound Induced Thermal Bioeffects: Recent Research at University of Vermont, Hewlett Packard, Andover, Massachusetts, 1992.

17. Thermal Bioeffects of Ultrasound, Ontario Cancer Institute and Department of Medical Biophysics, University of Toronto, 1992.

18. Discovery of Nonpropagating Solitons: A Transition from an Extended State to a Localized State, 14th International Congress of Acoustics, Beijing, People's Republic of China, September 1992.

19. Experimental Investigation of the Nonlinearity Parameter B/A of Water Enhanced by Trapped Bubbles, 14th International Congress of Acoustics, Beijing, People's Republic of China, September 1992.

20. Optical and Acoustical Tweezers, Joint Radiation Center, Harvard Medical School, March 1993.

21. Acoustic Cavitation and Anticancer Drug, Joint Radiation Center, Harvard Medical School, March 1993.

22. Acoustical and Optical Traps, Dept. of Physics, UVM, March1993.

22. Acoustic Radiation Force and Acoustical Tweezers used in Biomedical Research, 125th Meeting of Acoustical Society of America, Ottawa, May 1993. J. Acoust. Soc. Am. **93**, N0. 4, Pt. 2, 2329 (1993).

23. Acoustics: The Secret Weapon for Science, Graduate Study and Research in Biomedical Engineering Project, UVM, April, 1993.

24. Optical and Acoustical Tweezers and Their Biological Applications, Dept of Physics, University of Central Florida, January 1994.

25. Optical and Acoustical Tweezers and Their Biological Applications, Dept of

Physics, Lehigh University, July 1994.

26. Theoretical Principal of Optical Tweezers, Muscle Club, Molecular Physiology and Biophysics, UVM, Sept. 1994.

27. Ultrasound Safety, Third Annual "Vascular Physics and Technology Review," Department of Surgery, UVM, Sept. 1994.

28. Safety of Ultrasound Imaging System, Hewlett Packard, Andover, MA. Oct. 1994.

29. Ultrasound Safety, Fourth Annual "Vascular Physics and Technology Review," Department of Surgery, UVM, Sept. 1995.

30. Optical Traps and Molecular Motors, Dept. of Physics, Clarkson University, Nov. 1995.

31. Molecular Motors and Optical Tweezers, Institute of Chemistry, Chinese Academy of Sciences, Beijing, China, June, 1996.

32. Determination of Phase Velocity and Attenuation, Characterization of Materials, Hewlett Packard, Andover, MA. August, 1996.

33. Characterization of Materials Using Ultrasonic Spectroscopy, Dept. of Mechanical Engineering, UVM, Sept. 1996

34. Characterization of Materials Using Ultrasonic Spectroscopy, Dept. of Physics, UVM, Oct. 1996.

36. Safety of Ultrasound, Surgery Dept. UVM, Oct. 1996.

37. Optical Tweezers and Molecular Motors in Muscle, APS/NES, Burlington, VT, 1996.

38. Ultrasound Safety, 6th Annual "Vascular Physics and Technology Review," Department of Surgery, UVM, Sept. 1997.

39. Nonpropagating Hydrodynamic Solitons and Propagating Solitons in a Thin Shell, Dept. of Mathematics and Statistics, UVM, Oct. 1997.

40. Characterization of Materials using Ultrasonic Spectroscopy, SPIE's International Symposium, Medical Imaging 1998, San Diego, Feb. 1998.

41. Sonophoresis and Sonoporation, Mallinckrodt Inc., St. Luis, MO. June, 1998.

42. Sonophoresis and Sonoporation, Hewlett Packard, Andover, MA. August,

1998.

43. Biophysics Research at Dept. of Physics, UVM, BFGoodrich, Cleveland, Ohio, Sept. 1998.

44. Ultrasound Safety, 7th Annual "Vascular Physics and Technology Review," Department of Surgery, UVM, Sept. 1998.

45. Acoustical and Optical Tweezers, Dept. of Aerospace & Mechanical Engineering , Boston University, April, 1999.

46. Reflection at a Liquid-Solid Interface, Hewlett Packard, Andover, MA. April, 1999.

47. Ultrasound Safety, 8th Annual "Vascular Physics and Technology Review," Department of Surgery, UVM, Sept. 1999.

48. Sonoporation and Drug Delivery, Invited Keynote Speaker, First Annual Research Review of Optical Sciences & Engineering Research Center/13th Fiber&Electro-Optics Research Center, Virginia Tech, April, 2000

49. Sonoporation and ultrasound transfection assisted by contrast agents, Invited Talk, J. Acoust. Soc. Am. 108, Pt. 2: 2470, December, 2000.

50. In-vivo experimental results of restenosis detecting, Invited talk, Pittsburgh Medical Center, November, 2000.

51. Experimental Study of Sonic Effects of Electrical Toothbrushes, Gillette Co., Boston, February, 2001.

52. Applications of Laser and Ultrasound in Medicine, Invited Talk, NingXia University, China (2001).

53. A Possible Mechanism of Ultrasound-activated Gene Delivery: Shear Stress Generated by Microstreaming, Invited Talk, J. Acoust. Soc. Am **110**, Pt 2, 2668 (2001).

54. Smart Stents and Bubble Assistant Drug Delivery, Physics Dept., UVM (2001).

55. Sonophoresis and Sonoporation, Nanjing University, China (2002).

56. The Application of Sonophoresis and Sonoporation, Jiotung University, China (2002).

57. Deliver DNA and Drug on Target, Lehigh University (2002).

58. Study of Interaction of Actin and Myosin Molecules using Optical Tweezers, Fu-Jen University, Taipei (2003).

59. Deliver DNA and Drug on Target, Hong Kong University (2003).

60. Ultrasonic Imaging, Biomechanical Engineering Program, University of Vermont (2004).

61. Delivery of DNA and Antibodies into Cells using Sonoporation and Electroporation, Invited Talk, The 4th International Symposium on Therapeutic Ultrasound, Kyoto, Japan (Sept, 2004).

62. Sonoporation and Targeting DNA, Antibody and Drug Delivery, Physics Department, the Washington University in St. Louis, March (2005).

63. The Attenuation and Velocity of Longitudinal and Shear Waves in Impedance Modified Composites, Dr. Ronald A. Liston Seminar Series, Cold Regions Research and Engineering Laboratory, US Army, NH, September (2005).

64. Delivery of DNA and Drug on Target Using Ultrasound, Department of Mechanical Engineering, UVM, November, 2005.

65. Sonoporation and Drug Delivery, Department of Physics, Nanjing University, June, 2007.

66. Microstreaming, Acoustic Cavitation and Sonoporation, The College of Life Sciences, Xian Jiao-Ton University, China, July, 2007.

67. Emerging therapeutic ultrasound, Department of Physics, Nanjing University, September, 2007.

68. Applications of Ultrasound in Energy Harvesting and Environmental Protection, Chongqing University of Medical Sciences, Oct. 2007.

69. Sonoporation and Drug Delivery, Chongqing University of Medical Sciences, China, Dec. 2007.

70. Noninvasive Ablation of Tumors Using High Intensity Focusing Ultrasound (HIFU)– Emerging Extracorporeal Surgery, Physics Dept. UVM, Oct. 2008.

71. Noninvasive Ablation of Tumors Using High Intensity Focusing Ultrasound (HIFU)– Emerging Extracorporeal Surgery, Radiology Dept, UVM, Nov. 2008.

72. Controlled Drug Release using High Intensity Ultrasound, International Summer Workshop, July 2010, Chongqing China.

73. A feasibility study of controlled drug release from encapsulated nanometer liposomes using high intensity focused ultrasound, International Congress on Acoustics, Invited paper, August 24, 2010, Sydney, Australia.

74. The Correlation between Acoustic Cavitation and Sonoporation involved in Ultrasound-mediated DNA transfection with Polyethylenimine (PEI) *in vitro*, Invited Paper, International Congress on Acoustics, Invited paper, August 24, 2010, Sydney, Australia.

75. R. Andosca, J. Wu et al. MEMS-based Energy Harvesting and applications, NASA Tech Sensors Tech Forum, Oct. 2011, Cambridge, MA.

76. R. Andosca, J. Wu et al. Mass-loaded MEMS Piezoelectric Vibrational Energy Harvesters: Finite Element Modeling Comparison to Theoretical and Experimental , The PowerMEMS Workshop, December 2 - 5, 2012, Georgia Tech Hotel and Conference Center.

77. R. Andosca, J. Wu, Energy Harvesting Transducer Optimization for Continuous Power Needs, Invited presentation to the 2012 Advanced Power Electronics Conference and Exhibition, Orlando, FL, Feb 7, 2012.

78. J. Wu, Versatile applications of acoustic technologies, Dept. of Physics, UVM, Oct.16, 2013

79. J. Wu, M. Wargo, J. Marshall, Biofilm Mitigation by Ultrasound-Enhanced Targeted Liposome Treatment, NASA Jonson Center, March 21, 2013.

80. J. Wu, Keynote Speaker, Emerging noninvasive ultrasound applications in medicine, The International noninvasive medical treatment workshop, Chongqing China (2014).

81. J. Wu, Versatility of Contemporary Acoustic Technology, University of Chicago, October (2015)

Research Publications - Contributed Papers and Communications

1. J. Wu and I. Rudnick, *Measurements of Nonlinear Tuning Curves of Helmholtz Resonators*, J. Acous. Soc. Am. Suppl. 1, 78, S40, S8 (1985).

2. J. Wu and I. Rudnick, *Recent Experimental Developments in the Study of the*

Newly Discovered Nonpropagating Hydrodynamic Solitons, J. Acous. Soc. Am. Suppl. 1, 77, S21, I9, (1985).

3. R. Keolian, J. Wu and I. Rudnick, *Demonstrations of Nonlinear Oscillators and Solitons*, J. Acous. Soc. Am. Suppl. 1, 77, S35, P5 (1985).

4. J. Wu and I. Rudnick, *Measurements of the Nonlinear Tuning Curves of Thin Circular Disks*, J. Acous. Soc. Am. Suppl. 1, 80, S46, V8 (1986).

5. J. Wu, John Wheatley and I. Rudnick, *Nonlinear Flexural Modes in Thin Shells; Observation of Envelope Solitons*, J. Acous. Soc. Am. Suppl. 1, 80, S46, V7 (1986).

6. Brad Barber, J. Wu and I. Rudnick, *Correlation Between Frequency and Position of Soliton Creation*, J. Acous. Soc. Am. Suppl. 1, 80, S46, V6 (1986).

7. J. Wu, John Wheatley and I. Rudnick, *Observation of Envelope Solitons in a Thin Metallic Shell*, Bull. Am. Phys. Soc. 32, No. 1, 79 (1987).

8. J. Wu, John Wheatley and I. Rudnick, *Observation of Wavepulse Solitons in the Nonlinear Flexural Modes of a Thin Shell*, Bull. Am. Phys. Soc. 32, No. 4, 1020 (1987).

9. J. Wu, John Wheatley and I. Rudnick, *Observation of Envelope Solitons and Many Other Nonlinear Phenomena Produced by Flexural Modes in a Metallic Shell*, Bull. Am. Phys. Soc. 32, No. 3, 599 (1987).

10. I. Rudnick, J. Wu, John Wheatley, S. Putterman, *Flexural Wave Envelope Solitons in a Metallic Cylindrical Thin Shell*, Proceedings of the International Symposium of Nonlinear Acoustics, Novosibirsk, USSR (1987).

11. J. Wu and W. L. Nyborg, *Measurements of the Response of Gas-Filled Micropores to Ultrasound By Using PVDF Transducers*, J. Acous. Soc. Am. Suppl. 1, 84, S165, YY7 (1988).

12. E. Winkler and J. Wu, *Experimental Studies of a Quasi Two-Dimensional Nonpropagating Hydrodynamic Soliton*, J. Acous. Soc. Am. Suppl. 1, 85, LLL3, S155 (1989).

13. J. Wu and W. L. Nyborg, *Measurements of the Peak Frequency of Transmission Loss to Ultrasound Through Two-Dimensional Trapped Bubbles Versus the Amplitude of the Incident Wave*, J. Acous. Soc. Am. Suppl. 1, 85, LLL3 S155 (1989).
14. J. Wu, S. S. Work, and D. M. Warshaw, *Acoustic Radiation Forces Used to Control the Motion of a Glass Microneedle*, J. Acous. Soc. Am. Suppl. 1, 85, LLL3, S155 (1989).

15. J. Wu and G. Du, *Temperature Rise in a Focused Gaussian Beam of Ultrasound*, J. Acous. Soc. Am. Suppl. 1, 86, S29, K9 (1989).

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Professional Appointments

Associate Professor, University of Vermont (2000-present)
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Past Support

Two-dimensional crystallization for atomic force microscopy of membrane proteins.
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Development and Application of Low-Temperature AFM.
PI: Jie Yang.
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PI: Jie Yang (Co-PI: Z. Shao).
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Abstracts

1. *The physical mechanism of the close-packing of membrane-bound DNA in solution.* Jie Yang, Lijiang Wang and R. Daniel Camerini-Otero (1996) Biophys. J. 70 A370.
2. *Phase behaviors of supported bilayers studied with differential scanning calorimeter.* Jie Yang Bulletin of the American Physical Society (1996) 41, 126.
3. *AFM studies of lipid structures in supported bilayers.* Ye Fang and Jie Yang Bulletin of the American Physical Society (1996) 41, 251.
4. *Two-dimensional condensation of DNA and related structural characteristics.* Jie Yang, Bulletin of the American Physical Society (1997) 42, 34.
5. *Detergent-assisted self assembly of fatty acid layers on mica in solution.* Sean Hand and Jie Yang, Bulletin of the American Physical Society (1997) 42, 825.
6. *The phenomenaon of 2-D condensation of DNA on cationic lipid bilayers.* Jie Yang and Ye Fang, (1997) Biophys. J. 72, A136.
7. *The main phase transition of supported phosphatidylcholine bilayers*. Jie Yang and Jennifer Appleyard, (1999) Biophys. J. 76, A273.
8. Molecular forces in the adsorption of DNA molecules to three surfaces. Xian-E Cai and Jie Yang, (2001) Biophys. J. 80, 491a.
9. *Morphology and kinematics of Langmuir-Blodgett monolayers*. Matthew R. Mazloff and Jie Yang, Bulletin of the American Physical Society (2001) 46, 885.
10. The binding between cholera toxin and its receptor. Xian-E Cai and Jie Yang, (2002) Biophys. J. 82, 43a.
11. A second structural phase of Spermidine condensed DNA. Jie Yang, V. Adrian Parsegian and Donald C. Rau, (2003) Biophys. J. 84, 180a.
12. The interaction between α-hemolysin and egg-PC bilayers. Jie Yang, Xian-E Cai, Daniel Harries, Donald C. Rau, V. Adrian Parsegian, Stephen Cheley, and Hagan Bayley, (2004) Biophys. J. 86, 322a.
13. Study on Adhesions Between an Asphalt Binder and Aggregate Minerals Using Particle-Modified Atomic Force Microscope Probes. Li, Y., Yang, J., and Tan, T. In Transportation Research Board 94th Annual Meeting, Washington, D.C., 2015.

Invited Talks

1. Supported membranes for biological atomic force microscopy in solution. Jie Yang, Boston University, Physics Department, March 12, 1996.

2. 2-D condensation of DNA on cationic lipid bilayers revealed with in situ AFM imaging. Jie Yang, Symposium, 30th annual Scanning Meeting, 1997, May 10 - May 14, Chicago.
3. Nematic ordering of DNA on positively charged bilayers. Jie Yang, International Conference on the Morphology and Kinetics of Phase Separating Complex Fluids, Messina, Italy, June 24-28, 1997.
4. 2-D condensation of DNA on cationic lipid bilayers. Jie Yang, State University of New York at Albany, Physics Department, October 10, 1997.
5. Nematic ordering of DNA on positively charged bilayers. Jie Yang, McGill University, Physics Department, November 6, 1997.
6. High-resolution in situ AFM imaging of membrane proteins and DNA molecules. Jie Yang, Special Workshop, Cell Biology Annual Meeting, December, 1997.
7. Self-assembly and condensation of DNA on planar cationic lipid bilayers. Jie Yang, Symposium, MRS annual Fall Meeting, 1997, December, Boston.
8. Self-assembly of bio-materials. Jie Yang, Symposium, ACS Meeting, August 26-27, 1998, Boston.
9. The assembly of DNA on 2-D bilayer membranes. Jie Yang, Experimentalist of the week at the Institute of Theoretical Physics, University of California, Santa Barbara.
10. AFM as a force probe in bio-applications. Jie Yang, Chemistry Dept. Texas A&M University, Summer, 2003.
11. Condensation of DNA. Jie Yang, Physics Dept. Clarkson University, Spring, 2004.
12. Biological applications of AFM. Jie Yang, Physics Dept. University of Rhode Island, Spring, 2005.