UNIVERSITY OF SOUTH FLORIDA

DEPARTMENT OF PHYSICS

Tampa, Florida 33620
http://physics.usf.edu/

General University Information
President: Judy L. Genshaft
Dean of Graduate School: Dwayne Smith
University website: http://usf.edu/
School Type: Public
Setting: Urban
Total Faculty: 2,544
Total Graduate Faculty: -
Total number of Students: 50,577
Total number of Graduate Students: 10,810

Department Information
Department Chairman: Prof. David Rabson, Chair
Department Contact: Prof. Inna Ponomareva, Professor and Graduate Admissions Director
Total full-time faculty: 33
Full-Time Graduate Students: 58
Female Full-Time Graduate Students: 17
First-Year Graduate Students: 13
Female First-Year Students: 4
Total Post Doctorates: 6

Department Address
4202 E. Fowler Avenue, ISA 2019
Tampa, FL 33620
Phone: (813) 974-2871
Fax: (813) 974-5813
E-mail: phyadmissions@usf.edu
Website: http://physics.usf.edu/

ADMISSIONS

Admission Contact Information
Address admission inquiries to: Director of Graduate Admissions, Prof. Inna Ponomareva, Department of Physics, ISA 2019, University of South Florida, 4202 E. Fowler Ave., Tampa, FL 33620, USA
Phone: 813-974-7286
E-mail: iponomar@usf.edu
Admissions website: http://physics.usf.edu/graduate/

Application deadlines
Fall admission:
U.S. students: February 1 *Int'l. students*: February 1
Spring admission:
U.S. students: September 1 *Int'l. students*: September 1

Application fee
U.S. students: $30 *Int'l. students*: $30
Follow links for the university and departmental on-line applications at http://physics.usf.edu/graduate. During this process, you will be asked to pay a one-time application fee of $30.00 by credit card (Master Card, Visa, or Discover) or e-check.

Admissions information
For Fall of 2018:
Number of applicants: 104
Number admitted: 21
Number enrolled: 9

Admission requirements
Bachelor's degree requirements: Bachelor's degree in Physics or a closely related field (I.e., Mathematics) is required.
Minimum undergraduate GPA: 3.0

GRE requirements
The GRE is required.
There is no GRE cutoff or minimum score. For exceptional candidates GRE could be waived.

Subjective GRE requirements
The Subjective GRE is recommended.
No cutoff or minimum score requirement.

TOEFL requirements
The TOEFL exam is required for students from non-English-speaking countries.
PBT score: 550
iBT score: 79
See http://www.usf.edu/admissions/international/graduate/requirements-deadlines/english-proficiency.aspx for TOEFL alternatives.

Other admissions information
Undergraduate preparation assumed: Applicants' undergraduate preparation will normally include upper-level coursework in classical mechanics, quantum mechanics, electricity and magnetism, and statistical mechanics.

TUITION

Tuition year 2017–18:
Tuition for in-state residents
Full-time students: $431.43 per credit
Part-time students: $431.43 per credit
Tuition for out-of-state residents
Full-time students: $877.17 per credit
Part-time students: $877.17 per credit
Credit hours per semester to be considered full-time: 9
Deferred tuition plan: Yes
Health insurance: Yes, $2,410.00.
Other academic fees: See http://usfweb2.usf.edu/uco/studentaccounting/Other_Fees.asp
Academic term: Semester
Number of first-year students who received full tuition waivers: 12

Teaching Assistants, Research Assistants, and Fellowships
Number of first-year
Teaching Assistants: 7
Research Assistants: 1
Fellowship students: 1
Average stipend per academic year
Teaching Assistant: $21,527
Research Assistant: $21,527
Fellowship student: $25,000

FINANCIAL AID

Application deadlines
Fall admission:
U.S. students: February 1 *Int'l. students*: February 1
Spring admission:
U.S. students: September 1 *Int'l. students*: September 1

2019 GradSchoolShopper: Graduate Programs in Physics, Astronomy, and Related Fields (ISBN: 978-0-7354-1686-4) ©2018 American Institute of Physics

Loans

Loans are available for U.S. students.
Loans are not available for international students.
GAPSFAS application required: Yes
FAFSA application required: Yes

For further information

Address financial aid inquiries to: Director of Financial Aid, SVC 1102, University of South Florida, 4202 E. Fowler Ave., Tampa, FL 33620.
Phone: (813) 974-3700
Financial aid website: http://www.usf.edu/financial-aid

HOUSING

Availability of on-campus housing

Single students: Yes
Married students: Yes
Childcare Assistance: No

For further information

Address housing inquiries to: Housing and Residential Education, RAR 215, University of South Florida, 4202 E. Fowler Ave., Tampa, FL 33620.
Phone: (813) 974-0001
E-mail: housing@usf.edu
Housing aid website: http://www.housing.usf.edu/

Table A—Faculty, Enrollments, and Degrees Granted

		Enrollment Fall 2017		Number of Degrees Granted 2017–18 (2012–18)		
Research Specialty	2017–18 Faculty	Master's	Doctorate	Master's	Terminal Master's	Doctorate
Atomic, Molecular, & Optical Physics	5	–	5	–(10)	–	–(8)
Biophysics	7	1	11	–(5)	–(4)	1(9)
Condensed-Matter and Materials Physics	16	–	23	–(20)	–(7)	3(25)
Medical Physics in Cooperation with the Moffitt Cancer Institute	–	–	5	1(1)	–(1)	1(4)
Other	5	1	16	–	–(1)	1(2)
Total	33	2	47	10(36)	–(13)	16(103)
Full-time Grad. Stud.	–	1	69	–	–	–
First-year Grad. Stud.	–	1	9	–	–	–

GRADUATE DEGREE REQUIREMENTS

Master's: M.S. in Physics: there are two options both requiring one academic year of residence, and no foreign language requirement. (1) Thesis Option: minimum 30 credit hours in an approved program, six of which may be for thesis; final oral exam on the thesis is required. (2) Non-Thesis Option: minimum 30 credit hours in an approved program.

Doctorate: The Department of Physics offers a Ph.D. in applied physics. Research include biophysics, atomic, molecular & optical physics, condensed-matter and materials physics, computational physics, and medical physics. The Industrial Practicum (IP) is a unique feature of our PhD program allowing students to gain first-hand experience in a nonacademic environment, develop relationship with potential future employers, and enhance their career opportunities. Students have completed the IP in industry, in hospitals, and at national laboratories. Average completion is 5 years. Two forms are offered: PhD in Applied Physics and PhD in Applied Physics with Medical Physics concentration. Both require minimum 57 credit hours in an approved program. The detailed distribution is the follows: Core courses-15 Lab/computer training-3 Electives-12 Industrial practicum-3 Dissertation research-24 The concentration in medical physics is accredited by the Committee on the Accreditation of Medical-Physics Education Programs (CAMPEP).

SPECIAL EQUIPMENT, FACILITIES, OR PROGRAMS

Experimental and theoretical research in the Department of Physics is conducted in the following laboratories/programs:

Cellular and Molecular Biophysics Research Laboratory:

The lab is highly interdisciplinary, involving physics, physiology, cell biology, and molecular biology. The structural and functional relationship of membrane proteins, such as ion channels, membrane transporters, and electrogenic pump molecules, as well as their interfaces with external electromagnetic field, are currently studied. One of the projects is to study direct energy transform from inorganic energy to the living system by electrically activating the membrane electrogenic pump molecules, Na/K ATPases. Other projects include the study of percutaneous and targeted drug delivery, understanding the mechanisms underlying electrical injury, and the development of novel techniques for wound healing. The research involves both basic science and its practical application to biology and medicine. The research program is supported by the National Institutes of Health (NIH) since 1994, as well as by many other funding agencies. Our research is conducted and focused on cellular and molecular levels in nanoscales by using broad, state-of-arts techniques, including whole cell/patch clamps, various microscopic imagining systems such as multiple-laser confocal microscope and near field microscope, full line of cellular, and molecular biology technique. (wchen@usf.edu)

Soft Materials Physics Laboratory:
Many mechanical, dynamical and structural properties of materials remain poorly understood for reasons independent of system-specific chemistry. Great advances in understanding these properties can be achieved through coarse-grained and multiscale simulations that are computationally efficient enough to access experimentally accessible spatiotemporal scales yet ″chemically″ realistic enough to capture the essential physics underlying the properties under study. We have and will continue to concentrate on explaining poorly-understood behaviors of polymeric, colloidal, and nanocomposite systems through coarse-grained modeling and concomitant development of analytic theories. The general theme is to do basic research on topics that are of high practical interest. Current work includes studies of polymer crystallization and polymer-nanocomposite mechanics. Facilities include a 32-core workstation and access to USF's 500-node (5500-core) CIRCE cluster. (rshoy@usf.edu)

Condensed matter/materials physics optical and laser spectroscopy:

This laboratory is currently under development and is designed to apply state-of-the-art optical and laser spectroscopy techniques to study the fundamental properties of advanced materials. Some of the most advanced optical and laser spectroscopy techniques will be available, including multidimensional ultrafast laser spectroscopy possibly spanning a wide spectral range, and single nanostructure photoluminescence and lifetime spectroscopy. The aforementioned optical techniques will be combined to explore the electronic, vibrational, and light-matter interactions in a variety of advanced nanomaterials, correlated-electron materials, and organic/inorganic hybrid materials, used in renewable energy applications for harvesting and storage. Understanding their intrinsic properties will contribute in improving the device performance of solar cells and batteries, important to a renewable-energy future. (karaiskaj@usf.edu)

Digital Holography & Microscopy Laboratory (DHML):

The main theme of our research activities is in the development of novel imaging technologies, with emphasis in holographic and interferographic microscopy. In digital holography (DH), the hologram is recorded by a CCD camera, instead of photographic plates, and the holographic images are calculated numerically using the electromagnetic diffraction theory. This gives direct access to the phase profile of the optical field and leads to a number of powerful imaging techniques that are difficult or impossible in real space holography. Transparent objects, such as many biological cells, thin film structures, and MEMS devices, can be imaged that reveal minute thickness variations with nanometer precision. Optical tomography by digital interference holography (DIH) yields cross-sectional images of biological tissues without actually cutting into them. Cellular motility can be studied by imaging the adhesion layers between a crawling cell and the substrate through the DH of total reflection, important in the study of embryogenesis, neuronal growth, and cancer cell metastasis. Furthermore, we are not only able to image cells and their components but also manipulate them in full three dimensions, using patterns of light produced by holographic optical tweezers (HOT). Cells and organelles can be captured and tracked, coaxed into artificially patterned growth and motion, and operated on with micro manipulation and microsurgery. Students can expect to work on cutting-edge research topics and be trained extensively in advanced optical design and construction, digital image acquisition, computer programming, electronic instrumentation, and cellular and biomedical laboratory procedures. Digital holography is an emerging technology that has been experiencing exponential growth in the last decade, and has potential applications in wide-ranging areas including cellular microscopy, metrology, manufacturing processes and testing, medical imaging and diagnostics, biometry, environmental research, and food science, just to name a few. (mkkim@usf.edu)

Laboratory for Advanced Materials Science and Technology (LAMSAT):

Explores innovations in pulsed laser ablation and plasma processes for the growth of thin films of technologically significant materials, including super hard materials, magnetic materials, superconductors, and compound semiconductors for solar cells. Past NSF- and DOE-sponsored research projects have focused on the application of a dual-laser ablation process discovered in this laboratory to grow large-area, particulate-free films of Cu(InGa)Se2 and ZnO for solar cell applications, and to fabricate diamond and diamond-like carbon structures for MEMS applications. One of the recently funded NSF projects focuses on an hybrid process where chemical self-assembly and physical vapor deposition techniques are combined to grow vertically aligned nano-grained films of superhard materials. Novel optical techniques for high resolution, in-situ plasma imaging, and development of new laser-assisted plasma growth processes are being researched. The research encompasses thin film growth, nanostructures, dynamic optical process diagnostics, thin film analysis, characterization and process modeling leading to the fabrication of single-layer and hetero-structure devices. (pritish@usf.edu, switanach@usf.edu)

Functional Materials Laboratory:

This laboratory is equipped with experimental facilities for studying the electrical and magnetic properties of novel materials. Investigation of the material properties are done over a wide range in temperature ($2\ K < T < 350\ K$) and applied magnetic fields up to 7 Tesla. In addition, the frequency-dependent electromagnetic response is probed from DC to 6 GHz. A novel resonant radio-frequency (RF) method has been developed to accurately determine the magnetic anisotropy and switching in materials. Current research projects focus on studies of dynamic magnetic response and high-frequency impedance in nanoparticles, composites, thin films, magnetic semiconductors and multiferroic systems. These technologically important materials are promising candidates as building blocks for the next generation multifunctional device. Other interests include magnetocaloric effect in nanostructured materials, spin polarization studies, and physics of strongly correlated systems. Ongoing research support by NSF, DoD, and DOE. (sharihar@usf.edu)

The Bio-Nano Research Group:

The work of this laboratory is the investigation of the structure/function relationship in biological systems ranging from the single molecule to the multicellular level. Molecular level structures determine the materials properties of the system, which in turn determines the macroscopic biological function. Using the expertise in atomic force microscopy, fluorescence microscopy, rheology, and other techniques found in the laboratory, the physical properties of single molecules and macromolecules are measured, and bulk models are developed and experimentally tested. These models are used to help explain the biology or pathology of systems. Example projects within the lab include investigations of cell surface and extracellular matrix glycoproteins and glycosaminoglycans through single molecule imaging and force spectroscopy. The data from these experiments is used to develop models for the viscoelastic properties of solutions of these biopolymers, which are then tested experimentally. These rheological properties are important for the function of tissues ranging from joint interstitial fluids to lung epithelium and will be used to understand the behaviors observed in these systems. The outcomes of the lab are geared to make significant contributions to biomedicine, and as such require a close collaboration with the Departments of Biology and Chemistry and with the School of Medicine. The work is inherently multidisciplinary, and students develop a broad range of skills from physics, biology, and chemistry. (garrettm@usf.edu)

Novel Materials Laboratory:

The laboratory is designed for the synthesis and characterization (including structural, optical, electrical, thermal, and magnetic) of novel materials for technologically significant applications. The emphasis is on understanding the structure-property relationships of material systems, that is, how crystal structure variations affect the electrical, thermal, optical, magnetic, and mechanical properties of materials. The laboratory applies this understanding towards crystal growth and processing of new and novel materials for varying technologically significant applications. The research focus is on new materials for energy-related technologies. Current materials research includes new semiconductors for electronics and optoelectronics applications, transport properties of "open structured" semiconductors, nanocrystal synthesis and self-assembly approaches, and new magnetic materials. The research is supported by NSF, DOE, ONR, ARO, NASA, and industry. Close collaboration with industry is typical in this interdisciplinary Materials Physics research program that encompasses all aspects of physics and materials science. Students typically acquire a large variety of skill sets and apply this knowledge towards their applied physics research. (gnolas@usf.edu)

Materials Simulations Laboratory (MSL):

Director: Prof. I. I. Oleynik

The research program at MSL focuses on design of new materials and prediction of their structural, electronic, and mechanical properties using first-principles density functional theory and classical molecular dynamics. First-principles based evolutionary search algorithms are applied to design and characterize new materials at high pressures as well as their synthesis pathways upon transformation of precursor materials under compression in diamond anvil cells and/or by shock waves. Using atomic-scale simulation methods, such as density functional theory and classical MD, we investigate structural, electronic and mechanical properties of graphene, boron nitride, metal chalcogenides and other emergent 2D materials. Novel environment-dependent bond-order potentials for covalently bonded materials are being developed by coarse-graining the quantum mechanical electronic structure within a chemically intuitive tight-binding framework, and then implementing environment-dependent screening of interatomic interactions for the physically-correct description of bond breaking and re-making. We study high-strain-rate materials response, condensed phase shock wave and detonation phenomena in large-scale molecular dynamics simulations. (oleynik@usf.edu)

Condensed Matter Theory Research Group:

This group works in condensed-matter theory, with current projects in crystallography, biological data analysis, and magnetic systems. In collaboration with Dr. Benji Fisher, we have reformulated Fourier-space crystallography into the language of cohomology of groups and applied the results to a wider class of structures than previously considered. Continuing work focuses on homological invariants of a new kind and their possible physical implications. In biology, we have been collaborating with Dr. Chun-Min Lo on analysis of electric cell-substrate impedance-sensing experiments. Looking only at statistical signatures of electrical noise, tk;4we can distinguish cancerous from non-cancerous cell cultures of the same type of cell and can detect physiological effects of the toxin cytochalasin-B at lower concentrations than possible with other techniques. Recent work in magnetic systems includes a statistical-mechanical model of helimagnetism in rare-earth heterostructures and a study of the ballistic-to-diffusive crossover in quantum wires. The latter may have applications in quantum computing. (davidra@ewald.cas.usf.edu)

Laboratory of Optical Biophysics:

The overall research focus in our laboratory is on the basic physical principles that govern the phase separation and aggregation of proteins in solution. Depending on the specifics of the protein interactions and solution conditions, proteins can either stay soluble or undergo a variety of phase transitions. These phase transitions include crystallization, liquid-liquid phase separation, precipitation or formation of amyloid fibrils. We are using a variety of optical and spectroscopic techniques to study the thermodynamics and kinetics of these phase separation phenomena of proteins. Our current focus is on the mechanisms governing the self-assembly of a variety proteins into so-called amyloid fibrils. This aggregation process is the molecular hallmark for a large class of protein aggregation diseases, including Alzheimer's disease, Parkinson's disease, and even type-II diabetes. Aside from these biomedical applications, amyloid fibril formation has also been recognized as a unique model for general mechanisms of self-assembly of biomolecules into highly ordered nano- and biomaterials with intriguing mechanical and optical properties. We are pursuing both the biomedical and nanomaterials aspects of this assembly process in our current research. (mmuschol@usf.edu)

Computational Soft Matter Laboratory:

Interest of our group lie in the areas of computational bio-physics and mathematical modeling of biological and social systems. In this context, we focus on molecular dynamics simulations, Monte Carlo methods, multiscale modeling based on mean field theory, dynamical systems with an emphasis on Hamiltonian systems, associated numerical methods, and underlying parallel processing issues. Our current focus is on the study of lipid bilayer systems, which form integral components of cellular membranes. These systems are studied using various computational modeling techniques and validated through close interactions with experimentalists. One aspect of our current work involves the study of heterogeneous model membrane systems. We study the interactions between various membrane components such as phospho- and sphingolipids, and cholesterol that give rise to stable structures such as "rafts" and caveolae. We intend to develop a multiscale mean filed theory based model into a complete simulation methodology for membrane simulations. The models and methods developed will be used to study the structure and stability of membrane structures such as "raft" and caveolae, which are known to play critical roles in the activation of T-cells in immune response. (pandit@usf.edu)

Computational Condensed Matter Physics and Materials Science Program:

Research interest include the area of theoretical condensed matter physics with a focus on computational nanoscience. The materials of interest include semiconductors, ferroelectrics, ferromagnets, and multiferroics in both bulk and low-dimensional forms. Examples are nanotubes, nanowires, nanodots, and thin films. An exciting feature of such nanoforms is the appearance of new properties and phenomena that do not exist in bulk. The purpose of my research is to identify these novel features, study their fundamental aspects, and explore their new functionalities for future applications in nanoscale devices. An example is utilizing a novel vortex structure that is a unique feature of ferroelectric nanodots in ultrahigh density memory that may increase the current memory capacitance by orders of magnitude. Another research focus is the development of computational techniques that will expand their capabilities beyond existing levels. Examples include the development of first-principle-based techniques for new material forms (nanoscale ferroelectrics and multiferroics) and properties (dielectric loss and tunability). The ultimate research objective is the efficient design of new materials conducted in close collaboration with experimental groups. (iponomar@usf.edu)

Advanced Materials and Devices Theory Group:

Our group is engaged in various problems related to theoretical modeling and description of structural, functional, and nanoscale materials and devices. We pursue two complementary routes - analytical and computational. Analytical techniques based on quantum mechanics, quantum electrodynamics, and many-body theory, are being developed. First principle density functional theory and tight binding models on high-performance supercomputers are being utilized. Currently, we are pursuing problems related to the Casimir effect in nanostructured materials, thermoelectric properties of materials with enhanced cooling and power generation performances, simulations of nanostructured materials properties, and related devices. The projects are funded by various national funding agencies. Our group maintains strong collaborations with experimental teams as well as other theoretical groups from the University of South Florida, other universities and national research laboratories. We are devoted to conducting leading edge research to advance our understanding of complex materials and devices using analytical and computational methods. (lmwoods@usf.edu)

The Nanophysics and Surface Science Laboratory:

In this laboratory, we investigate condensed matter at the atomic scale. The surface of a material is where the action is; at a surface the material interacts with its environment and thus many chemical and physical processes occur at the interface between a solid and a different medium. Our goal is to understand the structural and electronic properties of surfaces and to tune these properties in order for the surface to perform new or improved functions. Currently investigated surface-functional materials are metal oxides for their use as solid state gas sensors and for solar energy conversion. Modification of surfaces with nanoclusters to improve their functionality is one approach to improve and create new functionalities.

Nanoclusters are aggregates of atoms in the realm between molecules and bulk materials. In this size range, condensed matter exhibits new properties, which can be conveniently tuned by controlling their size. In our laboratory, we assemble clusters atom by atom in the gas phase and subsequently place them on a support material. This allows investigating the cluster-support interaction and the cluster-size properties relationship. Most of the sample preparation and characterization is done under ultra high vacuum conditions to ensure the integrity of the samples under investigation. In addition to the in-house measurements, some supplementing photoemission and X-ray absorption studies are performed at synchrotron facilities. (mbatzill@usf.edu)

Soft Semiconductor Materials and Devices Laboratory:

This laboratory studies soft semiconductors with low dimensional electronic structure and are solution processable. Some examples are organic semiconductor, colloidal quantum dots, carbon nanotubes, and perovskites. One research focus is on systematic investigation of correlation between excitonic properties of thin films and electronic responses of pertinent devices. Technical approaches include optical study by linear (absorption, steady state and time-resolved photoluminescence) and various modulation (continuous wave photoinduced absorption, doping induced absorption & Electroabsorption) spectroscopies, and transport measurements using vertical (TOF, CELIV, SCLC, CV) and lateral (FET) device structures. Another major research line is to advance renewable energy technology by development of processing methodologies to integrate multifunctional materials onto soft substrates. One example is the fabrication of transparent and flexible organic solar module by solution-based techniques such as spray and printing. (xjiang@usf.edu)

Solid-State Quantum Optics Laboratory:

This laboratory is equipped with experimental facilities for studying quantum optical phenomena in solid-state nanostructures such as quantum dots, nanocrystals, and impurity centers. The long-term goal of this research is to realize controlled light-matter interactions for use in quantum communication and quantum information science. Optical techniques employed include high-resolution spectroscopy, interferometry, and multi-photon correlation measurements in both ambient and low-temperature (liquid-helium) environments. Novel optical microcavities are being developed to enhance the interactions of light with single quantum emitters and mechanical resonators for harnessing cavity-electrodynamics and cavity-optomechanics phenomena. (mullera@usf.edu)

Quantum Nonlinear Photonics Laboratory:

This laboratory is aimed to experimentally study quantum nonlinear photonics, a broadly defined field that investigates the physics and applications of the nonlinear and quantum aspects of photons and light-matter interaction. In specific, the lab is equipped with facilities to study photonic crystal and other nanophotonics devices on silicon-on-insulator chips and plasmonic nanostructures. Another part of the lab is aimed to develop new concepts of optical technologies that utilize nonclassical nature of light, especially to encode and retrieve information from an optical field in terms of color, amplitude, phase and polarization. (zhiminshi@usf.edu)

Microwave and Ultrafast Terahertz Research Laboratory:

This group focuses on research in theoretical modeling and experimental characterization of photonic structures including metamaterials, surface plasmons and photonic crystals. Numerical modeling and simulation techniques based on the finite element method and the finite-difference time-domain method are used to design functional photonic structures. State-of-the-art microwave and ultrafast terahertz equipments provide the capability of characterizing photonic materials over a wide frequency range. Researchers in this group are devoted to conducting cutting-edge research in both theoretical and experimental aspects of various photonic phenomena. Current research activities include studying nonlinear properties of photonic metamaterials, RF and solar energy harvesting metamaterials and surface plasmons. This group maintains strong collaboration and interaction with several leading research groups from other universities and national laboratories. (jiangfengz@usf.edu)

Astrophysics and Planetary-Science Laboratory:

Our group's main goal is to constrain physical and chemical models of the origins of planetary systems by obtaining and analyzing observations of comets and exoplanets. We perform spectroscopy, interferometry, and imaging at optical, infrared, and millimeter wavelength telescopes and collaborate with leading atmospheric theorists. (mariawomack@gmail.com)

Magnetism and Spin Dynamics Lab:

Our lab, currently under development, focusses on characterization of novel magnetic, multifunctional and strongly correlated materials via in-house techniques (ferromagnetic resonance, magneto-optical Kerr effect) and at national laboratories (electron microscopy and synchrotron-based spectroscopy). While our studies are fundamental in nature, the research has direct relevance to advanced technology for information storage and processing, microwave electronics, green technologies, novel sensors and other devices. (darena@usf.edu)

General Support Facilities:

Include a machine shop to build custom mechanical and vacuum parts and an electronics shop capable of custom design, repair, and fabrication of electronics and computer components.

Table B—Separately Budgeted Research Expenditures by Source of Support

Source of Support	Departmental Research	Physics-related Research Outside Department
Federal government	$2,589,710	
State/local government		
Non-profit organizations		
Business and industry		
Other	$142,603	
Total	$2,732,313	

Table C—Separately Budgeted Research Expenditures by Research Specialty

Research Specialty	No. of Grants	Expenditures ($)
Astrophysics	2	$61,632
Atomic, Molecular, & Optical Physics	7	$573,632
Biophysics	5	$477,597
Condensed Matter Physics	29	$1,619,450
Total	43	$2,732,311

FACULTY

Distinguished University Professor

Nolas, George S., Ph.D., Stevens Institute of Technology, 1994. *Applied Physics, Chemical Physics, Condensed Matter Physics, Energy Sources & Environment, Engineering Physics/Science, Materials Science, Metallurgy, Nano Science and Technology*. Experimental solid-state, materials, and condensed matter physics.

Professor

Batzill, Matthias, Ph.D., University of Newcastle upon Tyne, UK, 1999. *Applied Physics, Chemical Physics, Condensed Matter Physics, Materials Science, Metallurgy, Nano Science and Technology*. Surface science; gas-surface interactions; structure and electronic properties of metal oxide surfaces; nanoclusters and quantum dots; solid-state gas sensors; photocatalysis and photovoltaic for sustainable and renewable energy.

Chen, Wei, Ph.D., Temple University, 1988. *Biophysics*. Cellular and molecular biophysic; structure and function of membrane proteins; bioenergetics; new technique in synchronization modulation of the electrogenic pump molecules to electrically activate the pump functions, and its biomedical applications.

Kim, Myung K., Ph.D., University of California, Berkeley, 1986. *Applied Physics, Atomic, Molecular, & Optical Physics, Biophysics, Optics*. Digital holography; phase contrast microscopy; optical tomography; biomedical imaging; quantum optics; laser spectroscopy.

Mukherjee, Pritish, Ph.D., State University of New York at Buffalo, 1986. *Applied Physics, Atomic, Molecular, & Optical Physics, Chemical Physics, Condensed Matter Physics, Energy Sources & Environment, Materials Science, Metallurgy, Nano Science and Technology, Optics*. Picosecond lasers and applications; laser-assisted materials growth; nanostructures, thin films, and heterostructures of semi-conductors and oxides.

Oleynik, Ivan I., Ph.D., Russian Academy of Sciences, 1992. *Applied Physics, Chemical Physics, Computational Physics, Condensed Matter Physics, Nano Science and Technology*. Theoretical condensed matter and chemical physics; computational materials science.

Ponomareva, Inna, Ph.D., Russian Academy of Sciences, 2004. Graduate Admission Director. *Applied Physics, Computational Physics, Condensed Matter Physics, Materials Science, Metallurgy, Nano Science and Technology*. Condensed matter physics, numerical quantum chemistry, computational physics, nanoscience, developing and implementation of computational techniques.

Srikanth, Hariharan, Ph.D., Indian Institute of Science, 1993. *Applied Physics, Condensed Matter Physics, Materials Science, Metallurgy, Nano Science and Technology*. Experimental condensed matter; materials sciences.

Witanachchi, Sarath, Ph.D., State University of New York at Buffalo, 1989. *Applied Physics, Atomic, Molecular, & Optical Physics, Chemical Physics, Condensed Matter Physics, Energy Sources & Environment, Materials Science, Metallurgy, Nano Science and Technology, Optics*. Laser ablation, plasma processing, and chemical synthesis of films and nanostructures.

Woods, Lilia, Ph.D., University of Tennessee, 1999. Associate chair. *Applied Physics, Condensed Matter Physics, Materials Science, Metallurgy, Nano Science and Technology*. Theoretical condensed matter physics: theory and computation of nanostructures; dispersive interactions; thermoelectric transport.

Associate Professor

Arena, Dario, Ph.D., Rutgers University, 2000. *Condensed Matter Physics, Solid State Physics*. Condensed matter physics with emphasis on magnetic materials; spintronics; ultrafast dynamics and ferromagnetic resonance; correlated electron systems; experimental design; and data analysis. Experienced spectroscopist (x-ray, photoemission) with strong interest in microscopy.

Jiang, Xiaomei, Ph.D., University of Utah, 2004. *Applied Physics, Atomic, Molecular, & Optical Physics, Chemical Physics, Condensed Matter Physics, Energy Sources & Environment, Materials Science, Metallurgy, Nano Science and Technology, Optics*. Organic electronic materials; fabrication and characterization of light emitting diodes and photovoltaic devices for solar cell applications.

Karaiskaj, Denis, Ph.D., Simon Fraser University, 2002. *Applied Physics, Atomic, Molecular, & Optical Physics, Materials Science, Metallurgy, Nano Science and Technology, Optics*. Two-dimensional spectroscopy on nanostructures, and proteins; optical spectroscopic studies of carbon nanotubes; ultrahigh resolution spectroscopy of semiconductors.

Matthews, Garrett, Ph.D., University of North Carolina, 2001. *Applied Physics, Biophysics, Medical, Health Physics, Nano Science and Technology*. Biological macromolecules and macromolecular biopolymers.

Muller, Andreas, Ph.D., University of Texas, Austin, 2007. *Applied Physics, Atomic, Molecular, & Optical Physics, Optics*. Experimental quantum optics of nanostructures; quantum dots, nanocrystals, impurity centers; cavity quantum electrodynamics and optomechanics for quantum communication and quantum information science.

Muschol, Martin, Ph.D., City University of New York, 1992. *Applied Physics, Atomic, Molecular, & Optical Physics, Biophysics, Medical, Health Physics, Optics*. Neuronal plasticity; advanced optical techniques to probe cellular mechanisms; protein crystallization.

Pandit, Sagar A., Ph.D., University of Pune, India, 1999. *Applied Physics, Biophysics, Computational Physics, Condensed Matter Physics, Statistical & Thermal Physics*. Computational biophysics and mathematical modeling of biological and social systems.

Rabson, David, Ph.D., Cornell University, 1991. Department chair. *Applied Physics, Biophysics, Computational Physics, Condensed Matter Physics, Crystallography, Statistical & Thermal Physics, Theoretical Physics*. Condensed matter theory.

Ullah, Ghanim, Ph.D., Ohio University, 2006. *Applied Physics*. Neuronal disorders; Markov chain models; Calcium dynamics; Cell signaling pathways; Application of control theory to biology.

Zhou, Jiangfeng, Ph.D., Iowa State University, 2008. *Applied Physics, Atomic, Molecular, & Optical Physics, Condensed Matter Physics, Electrical Engineering, Electromagnetism, Optics*. Metamaterials, photonic crystals, plasmonics, numerical electromagnetics, and THz photonics.

Assistant Professor

Gutierrez, Humberto R., Ph.D., Universidade Estadual de Campinas, 2001. *Condensed Matter Physics, Materials Science, Metallurgy, Solid State Physics*. Condensed-matter experiment: synthesis and characterization of nanomaterials including carbon nanomaterials, two-dimensional transition-metal dichalcogenides, semiconductor nanowires and nanoclusters, and metallic and magnetic nanofilaments.

Hoy, Robert S., Ph.D., Johns Hopkins University, 2008. *Applied Physics, Computational Physics, Theoretical Physics*. Soft matter physics; Theoretical and Computational modeling of polymeric, colloidal, and nanocomposite systems; computational method development.

Pan, Jianjun, Ph.D., Carnegie Mellon University, 2009. Structure and function of membrane proteins; interactions between drug molecules and membrane proteins; structure and dynamics of fluid lipid membranes; protein-membrane interactions; drug-lipid composites.

Shi, Zhimin, Ph.D., University of Rochester, 2011. *Applied Physics, Atomic, Molecular, & Optical Physics, Optics, Quantum Foundations*. Quantum nonlinear photonics, nanophotonics, silicon photonics, photonic crystal, plasmonics, metamaterial. Optical methods utilizing non-classical nature of light.

Voronine, Dmitry, Ph.D., Bowling Green State University, 2004. *Applied Physics, Atomic, Molecular, & Optical Physics, Biophysics, Condensed Matter Physics, Medical, Health Physics*. I apply a variety of techniques in spectroscopy and imaging to biological, atomic, molecular and condensed matter systems, including the development of detectors for minute quantities of poisonous and carcinogenic molecules, and nanometer-scale chemical analysis of single biomolecules, 2D materials, and bacteria.

Research Professor

Womack, Maria P., Ph.D., Arizona State University, 1991. *Astronomy, Astrophysics, Planetary Science*. Observational imaging and spectroscopy of comets and exoplanets at optical, infrared, and mm-wavelengths.

Research Associate Professor

Phan, Manh-Huong, Ph.D., University of Bristol, 2006. *Applied Physics, Condensed Matter Physics, Materials Science, Metallurgy, Nano Science and Technology*. Nanomagnetism and magnetic materials; giant magnetoimpedance (GMI) materials; giant magnetocaloric (GMC) materials; colossal magnetoresistive (CMR) materials; nanoparticles and nanocomposites; multiferroic materials.

Research Assistant Professor

Lisenkov, Sergey, Ph.D., Russian Academy of Sciences, Moscow, 2005. *Applied Physics*. Finite-temperature properties of multiferroic materials; Perovskite superlattices and nanostructures; Electronic and stability properties of nanotubes and fullerenes.

Instructor

Criss, Robert, Ph.D., University of Texas, Dallas, 1993. *Applied Physics, Atomic, Molecular, & Optical Physics, Physics and other Science Education*. Applied VUV-VIS spectroscopy; physics education.

Mackay, Kevin, Ph.D., Queen's University, Belfast, N. Ireland, 2000. *Applied Physics, Astronomy, Astrophysics*. Extra-solar planets, astronomy education, and thin-film magnetic materials.

McCormick, Alexander, Ph.D., University of Maryland, 2015. *Astronomy, Astrophysics*. IR observation of galactic winds in nearby galaxies.

Pradhan, Gauri, Ph.D., University of Pune, 2002. *Biophysics, Statistical & Thermal Physics*. statistical mechanics, game theory, and mathematical modeling applied to primate behaviour.

Woods, Gerald, Ph.D., University of Tennessee, 2001. General Physics Lab Director. *Applied Physics, Condensed Matter Physics, Physics and other Science Education*. Experimental condensed matter.

DEPARTMENTAL RESEARCH SPECIALTIES AND STAFF

Theoretical

Applied Physics. The Ph.D. is in applied physics, interpreted broadly. While our research aims to answer fundamental scientific questions, it also often has practical applications (e.g., new electronic devices) in mind. The research often involves bringing to bear many different branches of physics. Arena, Batzill, Chen, Criss, Gutierrez, Hoy, Jiang, Karaiskaj, Kim, Lisenkov, Mackay, Matthews, McCormick, Mukherjee, Muller, Muschol, Nolas, Oleynik, Pan, Pandit, Phan, Ponomareva, Pradhan, Rabson, Shi, Srikanth, Ullah, Voronine, Witanachchi, Womack, Gerald Woods, Lilia Woods, Zhou.

Biophysics. Theoretical biophysics work in the department includes molecular-dynamics studies of membranes, simulation of calcium channels in cells, and cell-cell signaling in cancer. Chen, Matthews, Muschol, Pan, Pandit, Pradhan, Rabson, Ullah, Voronine.

Condensed Matter Physics. Theoretical work in the department includes both hard and soft condensed-matter physics; example systems include graphene and multiferroics. Arena, Batzill, Gutierrez, Hoy, Jiang, Karaiskaj, Kim, Lisenkov, Mukherjee, Muller, Nolas, Oleynik, Phan, Ponomareva, Rabson, Shi, Srikanth, Ullah, Voronine, Witanachchi, Lilia Woods, Zhou.

Medical, Health Physics. Our Ph.D. in Applied Physics with emphasis in medical physics, offered in collaboration with the Moffitt Cancer Institute on the USF campus, is one of 24 CAMPEP-accredited doctoral programs in medical physics in the United States. After the core coursework in pure and applied physics, as well as electives including radiology, nuclear medicine, and imaging, students undertake dissertation research under the supervision of Moffitt faculty members affiliated with USF Physics. Voronine.

Statistical & Thermal Physics. Stat-Mech research at USF encompasses applications in theoretical biophysics and hard and soft condensed matter. Hoy, Lisenkov, Oleynik, Pandit, Ponomareva, Pradhan, Rabson, Ullah, Lilia Woods.

Experimental

Applied Physics. The Ph.D. is in applied physics, interpreted broadly. While our research aims to answer fundamental scientific questions, it also often has practical applications (e.g., better thermoelectric materials) in mind. The research often involves bringing to bear many different branches of physics. Arena, Batzill, Chen, Gutierrez, Jiang, Karaiskaj, Kim, Matthews, Mukherjee, Muller, Muschol, Nolas, Pan, Phan, Shi, Srikanth, Voronine, Witanachchi, Womack, Zhou.

Astronomy. Multi-wavelength spectroscopy of solar-system bodies and the interstellar medium. Womack.

Astronomy, Astrophysics, Planetary Science. Current observational research focuses on imaging and spectroscopy of comets and exoplanets. Mackay, McCormick, Womack.

Atomic, Molecular, & Optical Physics. Areas of research include digital holographic microscopy, spectroscopy of correlated-electron systems, and metamaterials. Jiang, Karaiskaj, Kim, Muller, Shi, Voronine, Zhou.

Biophysics. Examples of experimental biophysics research in the department include the role of amyloid in Alzheimer's disease and neutron-scattering studies of cell membranes. Chen, Kim, Matthews, Muschol, Pan, Pandit, Ullah, Voronine.

Condensed-Matter and Materials Physics. Research areas include magnetism, graphene, and surface science, and materials for energy applications. Arena, Batzill, Gutierrez, Jiang, Karaiskaj, Lisenkov, Mukherjee, Muller, Nolas, Oleynik, Phan, Ponomareva, Rabson, Srikanth, Voronine, Witanachchi.

Medical, Health Physics. Our Ph.D. in Applied Physics with emphasis in medical physics, offered in collaboration with the Moffitt Cancer Institute on the USF campus, is one of 24 CAMPEP-accredited doctoral programs in medical physics in the United States. After the core coursework in pure and applied physics, as well as electives including radiology, nuclear medicine, and imaging, students undertake dissertation research under the supervision of Moffitt faculty members affiliated with USF Physics. Voronine.

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