WAYNE STATE UNIVERSITY

DEPARTMENT OF PHYSICS AND ASTRONOMY

Detroit, Michigan 48201
http://physics.clas.wayne.edu

General University Information

President: M. Roy Wilson, M.D., M.S.
Dean of Graduate School: Ambika Mather, Dean
University website: http://wayne.edu
School Type: Public
Setting: Urban
Total Faculty: 2,511
Total Graduate Faculty: 918
Total number of Students: 27,089
Total number of Graduate Students: 7,710

Department Information

Department Chairman: Prof. David A. Cinabro, Chair
Department Contact: David A. Cinabro, PhD, Chair
Total full-time faculty: 28
Total number of full-time equivalent positions: 28
Full-Time Graduate Students: 56
Female Full-Time Graduate Students: 7
First-Year Graduate Students: 7
Female First-Year Students: 2
Total Post Doctorates: 9

Department Address

666 West Hancock
Suite # 135 Physics Research Building
Detroit, MI 48201
Phone: (313) 577-2720 (C)
Fax: (313) 577-3932
E-mail: cinabro@wayne.edu
Website: http://physics.clas.wayne.edu

ADMISSIONS

Admission Contact Information

Address admission inquiries to: Dr. Claude Pruneau, Chairman, Graduate Admissions Committee, Dept. of Physics, Wayne State University, Detroit, MI 48201
Phone: (313) 577-2775
E-mail: pruneau@physics.wayne.edu
Admissions website: http://physics.clas.wayne.edu

Application deadlines

Fall admission:
U.S. students: June 1 *Int'l. students*: May 1
Spring admission:
U.S. students: February 1 *Int'l. students*: January 1

Application fee

U.S. students: $50 *Int'l. students*: $50
Wayne State is tri-Semester; Fall Semester(Begins in August) Spring/Summer Semester(Begins in May) Deadlines for Winter Semester; Winter Admission(Begins in January).

Admissions information

For Fall of 2018:
Number of applicants: 81
Number admitted: 10
Number enrolled: 7

Admission requirements

Bachelor's degree requirements: Bachelor's degree in Physics or related fields is required.
Minimum undergraduate GPA: 3.0

GRE requirements

The GRE is required.
Quantitative score: 700

Subjective GRE requirements

The Subjective GRE is recommended.
Minimum accepted Advanced GRE score: 700
Mean Advanced GRE score range (25th–75th percentile): 50

TOEFL requirements

The TOEFL exam is required for students from non-English-speaking countries.
PBT score: 550
iBT score: 79
550 or higher on paper-based test.

Other admissions information

Additional requirements: A GPA below 3.0 would require a probationary admission.
Undergraduate preparation assumed: J.R. Taylor, Classical Mechanics; D.J. Griffith, Introduction to Quantum Mechanics; Reitz, Milford and Christy Foundations of Electromagnetic Theory; A.H. Carter, Classical and Statistical Thermodynamics.

TUITION

Tuition year 2018–19:
Tuition for in-state residents
Full-time students: $690.36 per credit
Part-time students: $690.36 per credit
Tuition for out-of-state residents
Full-time students: $1,435.42 per credit
Part-time students: $1,435.42 per credit
Credit hours per semester to be considered full-time: 8
Deferred tuition plan: No
Health insurance: Not available.
Other academic fees: Registration Fee: $297.29.
Academic term: Semester

Teaching Assistants, Research Assistants, and Fellowships

Number of first-year
Teaching Assistants: 7
Average stipend per academic year
Teaching Assistant: $19,560
Research Assistant: $19,560
Fellowship student: $19,560
Assistantships/Fellowships, include Tuition Assistance, Medical and Dental benefits with co-pay.

FINANCIAL AID

Application deadlines

Fall admission:
U.S. students: June 30
Spring admission:
U.S. students: June 30

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: Wayne State University, Office of Student Financial Aid, The Welcome Center, 42 W. Warren Avenue, P.O. Box 2340, Detroit, MI 48202-0340; also; The Graduate School; gradschool.wayne.edu/funding.
Phone: (313) 577-2100
E-mail: studentservices@wayne.edu
Financial aid website: http://finaid.wayne.edu

HOUSING

Availability of on-campus housing

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

For further information

Address housing inquiries to: Wayne State University, Director, Housing & Residential Life, 5221 Gullen Mall, 582 Student Center Bldg., Detroit, MI 48202.
Phone: (313) 577-2116
E-mail: housing@wayne.edu
Housing aid website: http://www.housing.wayne.edu

Table A—Faculty, Enrollments, and Degrees Granted

Research Specialty	2017–18 Faculty	Enrollment Fall 2017		Number of Degrees Granted 2017–2018 (2013–18)		
		Master's	Doctorate	Master's	Terminal Master's	Doctorate
Applied Physics	–	–	–	–	–	–
Astrophysics	1	–	3	–(2)	–(3)	1(3)
Atomic, Molecular, & Optical Physics	1	–	–	–(7)	–(4)	–(3)
Biophysics	3	2	8	2(6)	–	1(4)
Condensed Matter Physics	9	–	11	2(62)	1(16)	4(43)
Low Temperature Physics	–	–	–	–	–	–
Materials Science, Metallurgy	–	–	–	–	–	–
Nuclear Physics	6	3	8	1(10)	–(7)	3(10)
Optics	–	–	–	–	–	–
Particles and Fields	7	–	16	–(15)	–(7)	3(19)
Physics and other Science Education	–	6	7	–	–	–
Total	27	11	53	5(102)	1(37)	12(82)
Full-time Grad. Stud.	–	6	58	–	–	–
First-year Grad. Stud.	–	2	7	–	–	–

GRADUATE DEGREE REQUIREMENTS

Master's: The Master degree is offered with (M.S.) and without (M.A.) thesis in various areas of physics. Requirements for the M.S. degree are 24 credits of course work at the 5000 level or above plus an eight-credit thesis, while the M.A. degree requires 29 credits of course work at the 5000 level or above plus a three-credit essay. Both degrees require at least nine credits at the 7000 level or above with at least half of the course work in physics. Students must maintain a 3.0 GPA and must complete their degree within six years. A final oral exam over the thesis or essay is required of all students.

Doctorate: The Ph.D. degree has a basic requirement of 90 credits, which include 30 dissertation credits. Courses at the graduate level in mathematical physics, mechanics and dynamics, quantum mechanics, electromagnetic theory, and statistical mechanics are required for all students as well as certain other courses depending on the area of concentration. A written Ph.D. qualifying exam usually taken after the end of the student's first year, a preliminary oral exam, and a final dissertation defense are the other major requirements. A 3.0 GPA must also be maintained. There is a seven-year time limit for completion of the degree.

Thesis: Thesis may be written in absentia.

SPECIAL EQUIPMENT, FACILITIES, OR PROGRAMS

The department has numerous well-equipped research laboratories with concentrated efforts in the areas of high-energy nuclear and particle physics, applied physics, biophysics, and condensed matter physics.

The relativistic heavy-ion group participates in two major international collaborations: the STAR experiment at the Relativistic Heavy-Ion Collider (RHIC) at Brookhaven National Laboratory NY, and the ALICE experiment at the Large Hadron Collider (LHC) at CERN in Switzerland. The group is a leader in using jets to probe the quark-gluon plasma and studying the nature of QCD phase transitions. On campus the group is part of the construction effort for the tracking system upgrade to ALICE.

The nuclear theory group is exploring a range of topics related to these experimental results, including the hydrodynamics of the quark-gluon plasma.

The experimental particle physics groups are part of the CMS collaboration at CERN, and the Belle II collaboration at KEK (Japan) and have set up facilities on campus for the design and development of electronic systems for the particle detectors and accelerators. They also have a leadership role in a future high energy electron-positron linear collider.

The particle theory group works on understanding the fundamental properties of elementary particles, including phenomenology of quantum chromodynamics in heavy quark systems, studies of CP-violation and Dark Matter.

The astrophysics group studies accreting systems such as neutron stars and black holes with x-rays.

Research programs in condensed matter physics have extensive materials characterization and synthesis facilities available for investigating problems ranging from superconductivity to magnetism to semiconductors to pattern formation to nano-confined fluids. There is a strong emphasis on nanotechnology, with research projects including studies on carbon nano-tubes and graphene, two-dimensional electron gas, nano-particles, and thin films. The materials characterization tools available include systems for electrical, dielectric, thermodynamic, and optical studies, all of which can be performed under a range of temperatures and magnetic fields. Some specialized measurements available for these studies include micro Raman spectroscopy, atomic force spectroscopy, X-ray photoemission spectroscopy, and fluorescence correlation spectroscopy. The condensed matter theory group uses state-of-the-art computer facilities along with analytical calculations to investigate the dynamics of systems far from equilibrium, pattern formation, and positron interactions with biologically relevant molecules.

The biophysics group is interested in applying techniques from Physics to solve problems in medicine and biology. Active projects in the biophysics group include studies of molecular motors, such as myosin, protein-binding interactions using atomic force microscopy, and cancer detection using Raman spectroscopy, structure of biologically active molecules with neutron scattering, and the structure and functionality of membranes.

Information about the graduate program and other research activities in the department is also available at http://physics.clas.wayne.edu.

Table B—Separately Budgeted Research Expenditures by Source of Support

Source of Support	Departmental Research	Physics-related Research Outside Department
Federal government	$8,531,056	
State/local government		
Non-profit organizations	$165,000	
Business and industry		
Other	$189,500	
Total	$8,885,556	

Table C—Separately Budgeted Research Expenditures by Research Specialty

Research Specialty	No. of Grants	Expenditures ($)
Astrophysics	6	$775,596
Biophysics	4	$1,442,795
Condensed Matter Physics	2	$507,748
Nuclear Physics	6	$1,643,040
Particles and Fields	11	$4,516,377
Other	–	
Total	29	$8,885,556

FACULTY

Professor

Bonvicini, Giovanni, Ph.D., Universita di Bologna, 1981. *Astrophysics, High Energy Physics, Particles and Fields*. Experimental high-energy particle, CLEO, astrophysics.

Cinabro, David A., Ph.D., University of Wisconsin-Madison, 1991. Chair of the Department. *Astrophysics, High Energy Physics, Particles and Fields*. Astrophysics; high-energy physics; particles and fields; experimental high-energy particle physics; heavy flavor physics in e+e- collisions at Belle observational astrophysics; supernova cosomology.

Gavin, Sean, Ph.D., University of Illinois, 1987. *Nuclear Physics, Theoretical Physics*. Theoretical nuclear; relativistic heavy-ion physics; quark gluon plasma theory; QCD phenomenology.

Harr, Robert F., Ph.D., University of California, Berkeley, 1990. *High Energy Physics, Particles and Fields*. High-energy physics, particles, and fields; experimental high-energy particle physics; searches for new particles through rare decays and CP violation at CMS.

Hoffmann, Peter M., Ph.D., Johns Hopkins University, 1999. *Condensed Matter Physics, Nano Science and Technology*. Experimental soft condensed matter physics; biophysics; nanomechanics; atomic force microscopy studies of interatomic and intermolecular forces.

Huang, Zhi-Feng, Ph.D., Tsinghua University, 1997. *Condensed Matter Physics, Nano Science and Technology, Theoretical Physics*. Theoretical condensed matter physics; nonequilibrium and nonlinear phenomena in complex dynamical systems; nanostructures and defect dynamics in strained thin films; mesophase dynamics of block copolymer films; nonlinear pattern formation and defect chaos.

Karchin, Paul E., Ph.D., Cornell University, 1982. *Particles and Fields*. Particles and fields; experimental particle physics; CMS experiment; lepton and quark substructure; muon detection detector develop; electronics.

Nadgorny, Boris E., Ph.D., Stony Brook University, 1996. *Condensed Matter Physics*. Experimental condensed matter physics, superconductivity, magnetism and spintronics materials, transport, tunneling and percolation effects.

Naik, Ratna, Ph.D., West Virginia University, 1982. Associate Dean for Academic Personnel and Faculty Affairs, College of Liberal Arts and Sciences. *Condensed Matter Physics*. Experimental condensed matter physics; materials science, magnetism, and magnetic materials; magnetic nanoparticles; sensor materials.

Petrov, Alexey A., Ph.D., University of Massachusetts, Amherst, 1997. *Astrophysics, Particles and Fields*. Theoretical particle physics; heavy quark physics; CP violation; QCD; LHC phenomenology; effective field theories; theoretical particle astrophysics: dark matter.

Pruneau, Claude A., Ph.D., Universite Laval, Quebec, 1987. *High Energy Physics, Nuclear Physics*. Experimental nuclear physics; RHIC (relativistic heavy-ion collisions), LHC (Cern); quark gluon plasma.

Voloshin, Sergei A., Ph.D., Moscow Engineering & Physics Institute, 1980. *High Energy Physics, Nuclear Physics*. Experimental nuclear physics; RHIC (relativistic heavy-ion collisions); phenomenology of multiparticle production.

Wadehra, Jogindra M., Ph.D., New York University, 1977. Associate Department Chair and Department Graduate Advisor. *Astrophysics, Atomic, Molecular, & Optical Physics, Theoretical Physics*. Theoretical atomic and molecular physics; astrophysics; the scattering of positrons (antiparticles of electrons) and electrons from various atoms and molecules.

Associate Professor

Cackett, Edward M., Ph.D., University of St. Andrews, 2006. *Astronomy, Astrophysics*. Observational Astrophysics; compact objects (neutron stars and black holes), accretion across the mass scale; from neutron stars and black holes in X-ray binaries to Active Galactic Nuclei (AGN).

Chu, Xiang-Qiang, Ph.D., Massachusetts Institute of Technology, 2010. *Biophysics*. Experimental biophysics; probing the structure and dynamics of biomolecules, nanomaterials; protein structures and dynamics using neutron and x-ray scattering.

Huang, Jian, Ph.D., Michigan State University, 2001. *Condensed Matter Physics, Low Temperature Physics, Nano Science and Technology*. Experimental condensed matter physics; interaction-driven phenomena in strongly correlated 1D and 2D systems (i.e. quantum Wigner Solids); quantum Hall effects; quantum charge and spin effects in mesoscopic and nano systems; semiconductor physics; low temperature (mK) techniques and quantum transport; nanofabrication and nanomaterials (graphene, VO2, MoS2).

Llope, William J., Ph.D., State University of New York-Stony Brook, 1992. *Nuclear Physics*. Experimental high-energy nuclear physics; development of detector hardware and data software analyzing large experiments; study of the QCD phase diagram via fluctuation observables.

Majumder, Abhijit, Ph.D., McGill University, Montreal, 2002. *Nuclear Physics, Theoretical Physics*. Theoretical nuclear physics; study of extended systems of QCD matter; perturbative QCD calculations; lattice QCD simulations.

Mukhopadhyay, Ashis, Ph.D., Kansas State University, 2000. *Condensed Matter Physics*. Experimental soft condensed matter physics; materials science.

Padmanabhan, Karur R., Ph.D., University of Poona, 1975. *Condensed Matter Physics*. Experimental condensed matter physics; materials science, materials modification; ion-solid interaction and ion channeling.

Paz, Gil, Ph.D., Cornell University, 2006. *High Energy Physics, Particles and Fields, Theoretical Physics*. Theoretical particle physics; QCD; effective field theories; supersymmetry.

Putschke, Joern H., Ph.D., Technical University of Munich, 2004. *High Energy Physics, Nuclear Physics*. Experimental high-energy nuclear physics; RHIC (relativistic heavy-ion collisions).

Sakamoto, Takeshi, Ph.D., Kanazawa University, 2001. *Biophysics, Medical, Health Physics*. Experimental biophysics: mechanisms of myosin-dependent motility, protein-protein interactions, actin-myosin interactions and visualization using single-molecule imaging techniques in vitro and in vivo.

Zhou, Zhixian, Ph.D., Florida State University, 2004. *Condensed Matter Physics, Nano Science and Technology*. Experimental condensed matter physics: Individual nanoscale materials and single organic molecules: synthesis and characterization, nanoscale device fabrication, electrical transport measurements.

Assistant Professor

Kelly, Christopher V., Ph.D., University of Michigan-Ann Arbor, 2009. *Biophysics*. Experimental biophysics; subdiffraction-limited optics and biological membranes; spectroscopy.

Matos Abiague, Alex, Ph.D., Martin-Luther-Universitat Halle-Wittenberg, 2004. *Computational Physics, Condensed Matter Physics, Theoretical Physics*. Theoretical condensed matter and computational physics.

Shah, Nausheen R., Ph.D., University of Chicago, 2009. *High Energy Physics, Particles and Fields*. Theoretical studies of the Higgs and dark matter lamp posts for physics at the weak scale.

Shen, Chun, Ph.D., The Ohio State University, 2014. *Nuclear Physics, Theoretical Physics*. Theoretical Nuclear Physics - Precision fluid dynamical modelling of quark-gluon plasma at finite baryon density; Jet and electromagnetic tomography in strongly-coupled systems; Rapid thermalization and out-of-equilibrium physics of many-body QCD; Gluon saturation and 3D imaging of nucleus at high energy.

DEPARTMENTAL RESEARCH SPECIALTIES AND STAFF

Theoretical

Atomic, Molecular, & Optical Physics. Studying the scattering of positrons (antiparticles of electrons) and electrons from various atoms and molecules. Wadehra.

Computational Nuclear Physics-Interdisciplinary. Distributed and high performance computing applications to simulations of nuclear collisions; Monte Carlo simulation, Algorithms, Data Science, Bayesian Statistical analysis, Heterogeneous Computation Architectures. Majumder, Putschke.

Condensed Matter Physics. Material structures and growth; multiple-scale modeling; non-equilibrium phenomena in complex systems; spintronics; topological phases of matter; two-dimensional materials. Zhi-Feng Huang, Matos Abiague.

Nuclear Physics. QCD phenomenology; relativistic heavy-ion collisions; quark gluon plasma; extended systems of QCD matter at all temperatures and densities that are experimentally accessible; Jet & electromagnetic tomography in strongly-coupled systems; Gluon saturation and 3D imaging of nucleus at high energy. Gavin, Majumder, Shen.

Particles and Fields. Heavy quark physics, CP violation, electroweak physics, and QCD phenomenology; Higgs, dark matter, and beyond the Standard Model phenomenology and model building. Paz, Petrov, Shah.

Plasma and Fusion. Production and diagnostics of negative ion beams. Wadehra.

Experimental

Astrophysics. Accretion onto neutron stars and black holes in X-ray Binaries & Active Galactic Nuclei (AGN), Relativistic Fe Lines in neutron star los-mass X-ray binaries, observational probes of the neutron star equation of state (neutron star radii and masses). Cackett.

Biophysics. Molecular Motor. Single molecule imaging studies with Total Internal Reflection Fluorescent (TIRF)microscopy. Measuring single-/multiple-power stroke of molecular motor by using Optical tweezers, Traction force microscopy for cancer research. Molecular and cellular imaging, protein dynamics using neutron and X-ray scattering. Biological Physics - Subdiffraction-limited optics and biological membranes by using nanoscale engineering and biophysical techniques. Single-molecule and live cell atomic force microscopy. Chu, Hoffmann, Kelly, Sakamoto.

Condensed Matter Physics. Atomic force and scanning tunneling microscopy of surfaces; Magnetic materials and device applications; Conventional and high-temperature superconductivity; Andreev reflection; Electron and Josephson tunneling; Spin transport and spin polarization; Spintronics; Ion channeling; Thin-film and materials research; Surface studies and modification; Energy storage and generation materials; Calorimetric and ultrasonic properties; Raman spectroscopy; Soft matter physics, polymers and nano-confined liquids. Hoffmann, Jian Huang, Mukhopadhyay, Nadgorny, Naik, Padmanabhan, Zhou.

Nuclear Physics. High energy nuclear collisions, quark-gluon plasma, strongly interacting matter at extreme temperatures and densities. Llope, Pruneau, Putschke, Voloshin.

Particles and Fields. Exotic searches and precision measurements at LHC/CMS; Micro-pattern gas and silicon micro-strip detector development, heavy quark physics at KEK/BELLE; Electron beamstrahlung detector development. Bonvicini, Cinabro, Harr, Karchin.

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