MONTANA STATE UNIVERSITY

DEPARTMENT OF PHYSICS

Bozeman, Montana 59717-3840
http://www.physics.montana.edu

General University Information

President: Waded Cruzado
Dean of Graduate School: Karlene A. Hoo
University website: http://www.montana.edu
Control: Public
Setting: Rural
Total Faculty: 955
Total Graduate Faculty: N/A
Total number of Students: 15,688
Total number of Graduate Students: 1,981

Department Information

Department Chairman: Prof. Yves U. Idzerda, Head
Department Contact: Margaret Jarrett, Graduate Program Coordinator
Total full-time faculty: 17
Total number of full-time equivalent positions: 44
Full-Time Graduate Students: 61
First-Year Graduate Students: 13
Female First-Year Students: 2
Total Post Doctorates: 6

Department Address

264 Barnard Hall
Bozeman, MT 59717-3840
Phone: (406) 994-3614 (C)
Fax: (406) 994-4452
E-mail: jarrett@montana.edu
Website: http://www.physics.montana.edu

ADMISSIONS

Admission Contact Information

Address admission inquiries to: Prof. Rufus Cone, Dept. of Physics, Montana State University, Bozeman, MT 59717.
Phone: (406) 994-6175
E-mail: cone@montana.edu
Admissions website: http://www.physics.montana.edu

Application deadlines

Fall admission:
U.S. students: January 1 *Int'l. students*: January 1

Application fee

U.S. students: $60 *Int'l. students*: $60
New graduates are only accepted for Fall term enrollment.

Admissions information

For Fall of 2015:
Number of applicants: 48
Number admitted: 13
Number enrolled: 13

Admission requirements

Bachelor's degree requirements: Four-year Bachelor's degree in Physics or a related field is required.
Minimum undergraduate GPA: 3.0

GRE requirements

The GRE is required.
Quantitative score: 157
Verbal score: 155
Analytical score: 3.5
No minimum percentile, only raw score. See "Other admission information".

Advanced GRE requirements

The Advanced GRE is required.
Minimum accepted Advanced GRE score: 570
No minimum percentile, only raw score. See "Other admissions information".

TOEFL requirements

The TOEFL exam is required for students from non-English-speaking countries.
PBT score: 600
iBT score: 80
Overall score of 80 on iBT-TOEFL is required of all international students who wish to attend MSU. A score of 26 on the speaking portion is required for teaching assistantships.

Other admissions information

Additional requirements: Successful students in our program usually have GRE scores that exceed: verbal–70%, quantitative–80%, analytical–4.0, and physics–40%.
Undergraduate preparation assumed: Marion or Symon, Classical Mechanics; Griffiths, Electricity and Magnetism; Libof or Gasiorowicz, Quantum Mechanics; Reif, Statistical and Thermal Physics.

TUITION

Tuition year 2016–17:
Tuition for in-state residents
Full-time students: $6,850 annual
Tuition for out-of-state residents
Full-time students: $22,900 annual
Credit hours per semester to be considered full-time: 9
Deferred tuition plan: Yes
Health insurance: Available at the cost of $2,950 per year.
Academic term: Semester
Number of first-year students who received full tuition waivers: 13

Teaching Assistants, Research Assistants, and Fellowships

Number of first-year
Teaching Assistants: 13
Average stipend per academic year
Teaching Assistant: $17,000
Research Assistant: $17,000
Fellowship student: $17,000

FINANCIAL AID

Application deadlines

Fall admission:
U.S. students: October 1
Spring admission:
U.S. students: March 1

Loans

Loans are available for U.S. students.
Loans are not available for international students.
GAPSFAS application required: No
FAFSA application required: No

For further information

Address financial aid inquiries to: Dr. Rufus Cone, Dept. of Physics, Montana State University, Bozeman, MT 59717.
Phone: (406) 994-6175
E-mail: cone@montana.edu
Financial aid website: http://www.montana.edu/wwwfa/

HOUSING

Availability of on-campus housing

Single students: Yes
Married students: Yes

For further information

Address housing inquiries to: Family & Graduate Housing, 1502 W Garfield, Bozeman, MT 59717.
Phone: (406) 994-3730
E-mail: housing@montana.edu
Housing aid website: http://www.montana.edu/fgh

Table A—Faculty, Enrollments, and Degrees Granted

Research Specialty	2015–16 Faculty	Enrollment Fall 2015		Number of Degrees Granted 2015–16 (2011–16)		
		Master's	Doctorate	Master's	Terminal Master's	Doctorate
Astrophysics	2	–	4	–(3)	–(1)	–(2)
Atmosphere, Space Physics, Cosmic Rays	1	–	2	1(1)	–	–
Condensed Matter Physics	7	1	13	–(5)	2(5)	–(6)
Optics	6	–	9	1(7)	–(4)	1(2)
Physics and other Science Education	2	–	3	1(1)	–(1)	–(1)
Relativity & Gravitation	3	1	13	2(6)	1(1)	–(3)
Solar Physics	9	–	15	1(4)	1(4)	4(8)
Total	30	2	59	6(29)	4(16)	5(22)
Full-time Grad. Stud.	–	2	59	–	–	–
First-year Grad. Stud.	–	–	13	–	–	–

GRADUATE DEGREE REQUIREMENTS

Master's: Twenty credits plus a thesis or 30 credits without a thesis in an approved program with satisfactory performance are required. An M.S. examination and two semesters of residency are required. There are no language requirements.

Doctorate: A minimum of 40 credits of acceptable course work; dissertation; satisfactory performance on comprehensive and dissertation examinations, and four semesters of residency are required. There are no language requirements.

Thesis: Thesis may be written in absentia.

SPECIAL EQUIPMENT, FACILITIES, OR PROGRAMS

Optical physics and laser spectroscopy laboratories, including lasers ranging from the ultrastable (few Hz linewidths) to the ultrafast (femtosecond pulses), for research in spectral hole burning phenomena, LIDAR and LADAR, ultrafast holography, smart pixel sensors, optical frequency standards, and ultrastable optical lasers and cavities; Spectral Information Technology Laboratory (Spectrum Lab) and Optical Technology Center (OpTeC), fostering collaborations with local optics industries, and with several national and international laboratories and companies; millimeter-wave magneto-spectroscopy facility; Magnetic Nanostructure Growth and Characterization Facility for synthesis using MBE, PLD, and MoCVD and characterization of magnetic films, particles, and interfaces using X-ray synchrotron techniques; Image and Chemical Analysis Laboratory; Montana Space Grant Consortium, a statewide program for research, education, and outreach in space science; Space Science and Engineering Laboratory with facilities for the design, development, and testing of small satellite hardware and solar and space physics spaceflight instrumentation; public outreach programs in astrophysics, solar physics, and Mars exploration.

Table B—Separately Budgeted Research Expenditures by Source of Support

Source of Support	Departmental Research	Physics-related Research Outside Department
Federal government	$5,342,242	
State/local government		
Non-profit organizations		
Business and industry		
Other		
Total	$5,342,242	

FACULTY

Professor

Babbitt, William R., Ph.D., Harvard University, 1987. *Optics*. Optical physics; applied optics.

Cone, Rufus, Ph.D., Yale University, 1971. *Condensed Matter Physics, Optics*. Quantum optics; optical materials; lasers.

Cornish, Neil, Ph.D., University of Toronto, 1996. *Cosmology & String Theory, Relativity & Gravitation, Theoretical Physics*. Relativity theory; cosmology.

Francis, Gregory E., Ph.D., Massachusetts Institute of Technology, 1987. *Physics and other Science Education*. Physics education.

Idzerda, Yves, Ph.D., University of Maryland, 1986. Department Head. *Condensed Matter Physics, Nano Science and Technology, Solid State Physics, Surface Physics*. Surface and interface physics; magnetic materials; synchrotron techniques.

Kankelborg, Charles, Ph.D., Stanford University, 1996. *Solar Physics*. Solar physics.

Link, Bennett, Ph.D., University of Illinois, 1991. *Astrophysics, Theoretical Physics*. Astrophysics.

Longcope, Dana, Ph.D., Cornell University, 1993. *Plasma and Fusion, Solar Physics, Theoretical Physics*. Plasma physics.

Neumeier, John J., Ph.D., University of California, San Diego, 1990. *Condensed Matter Physics, Low Temperature Physics*. Thermal expansion; phase transitions.

Rebane, Aleksander, Ph.D., University of Estonia, 1985. *Optics*. Optics; lasers.

Tsuruta, Sachiko, Ph.D., Columbia University, 1964. *Astrophysics, Theoretical Physics*. Astrophysics; compact objects.

Associate Professor

Malovichko, Galina I., Ph.D., University of Kiev, 1987. *Condensed Matter Physics*. Optical materials.

Qiu, Jiong, Ph.D., Nanjing University, 1998. *Solar Physics, Theoretical Physics*. Solar Physics.

Vorontsov, Anton, Ph.D., Northwestern University, 2004. *Condensed Matter Physics, Low Temperature Physics, Theoretical Physics*. Theoretical condensed matter physics.

Assistant Professor

Sample, John, Ph.D., University of California - Berkeley, 2013. *Atmosphere, Space Physics, Cosmic Rays*. Experimental atmospheric and space physics.

Willoughby, Shannon, Ph.D., Tulane University, 2003. *Astronomy, Condensed Matter Physics, Physics and other Science*

Education, Theoretical Physics. Theoretical condensed matter physics; physics and astronomy education.

Yunes, Nico, Ph.D., Pennsylvania State University, 2008. *Cosmology & String Theory, Relativity & Gravitation, Theoretical Physics*. Gravitational waves and quantum gravity.

Emeritus

Hermanson, John C., Ph.D., University of Chicago, 1966. *Condensed Matter Physics, Surface Physics, Theoretical Physics*. Surface physics theory.

Kirkpatrick, Larry, Ph.D., Massachusetts Institute of Technology, 1968. *High Energy Physics, Physics and other Science Education*. Science education.

Lapeyre, Gerald J., Ph.D., University of Missouri, Columbia, 1962. *Condensed Matter Physics, Surface Physics*. Photoemission; semiconductor materials; electron energy loss.

Schmidt, V. Hugo, Ph.D., University of Washington, 1961. *Condensed Matter Physics, Energy Sources & Environment*. Alternate energy.

Smith, Richard J., Ph.D., Iowa State University, 1975. *Condensed Matter Physics, Materials Science, Metallurgy, Surface Physics*. Ion beams; surface physics.

Wheeler, Gerald, Ph.D., Stony Brook University, 1972. *Nuclear Physics, Physics and other Science Education*. Experimental nuclear physics; science education.

Professor Emeritus

Carlsten, John, Ph.D., Harvard University, 1974. *Optics*. Nonlinear optics; laser spectroscopy; atomic physics.

Research Professor

Acton, Loren W., Ph.D., University of Colorado, 1965. *Solar Physics*. Solar physics.

Avci, Recep, Ph.D., University of Illinois, 1978. *Biophysics, Condensed Matter Physics, Surface Physics*.

Canfield, Richard C., Ph.D., University of Colorado, 1968. *Solar Physics*. Solar physics.

Craig, Alan, Ph.D., University of Arizona, 1982. *Condensed Matter Physics, Nano Science and Technology, Optics*. Coherent optics applications.

Hellings, Ronald, Ph.D., Montana State University, 1972. *Relativity & Gravitation, Theoretical Physics*. Relativity theory.

Klumpar, David M., Ph.D., University of New Hampshire, 1972. *Atmosphere, Space Physics, Cosmic Rays*. Experimental space physics; space instrumentation.

McKenzie, David E., Ph.D., University of Delaware, 1997. *Solar Physics*. Solar Physics.

Research Assistant Professor

DesJardins, Angela, Ph.D., Montana State University, 2007. Director, Montana Space Grant Consortium. *Solar Physics*. Solar Physics.

Leamon, Robert J., Ph.D., University of Delaware, 1999. *Solar Physics*. Solar physics.

Teaching Professor

Riedel, Carla M., Ph.D., University of Minnesota, 1996. *Nuclear Physics*. Nuclear physics.

Teaching Assistant Professor

Childs, Nicholas B., Ph.D., Montana State University, 2012. *Condensed Matter Physics*. Physics Education Research.

Rugheimer, Paul P., Ph.D., University of Wisconsin - Madison, 2004. *Condensed Matter Physics, Surface Physics*. Thin film physics.

DEPARTMENTAL RESEARCH SPECIALTIES AND STAFF

Theoretical

Astrophysics. Neutron stars; active galactic nuclei; gamma-ray bursters. Link, Riedel, Tsuruta.

Condensed Matter Physics. Correlated many-body (collective) effects such as superconductivity and superfluidity; influence of magnetic fields, impurities, and fluctuations on superconducting properties. Vorontsov.

Physics and other Science Education. Developing and implementing innovative programs for primary and secondary teacher education; developing techniques in education of non-science majors. Francis, Willoughby.

Relativity & Gravitation. Gravitational waves; black holes; quantum theory of gravity; early universe; experimental relativity. Cornish, Hellings, Wheeler, Yunes.

Experimental

Atmosphere, Space Physics, Cosmic Rays. Space instrumentation, including ultraviolet optics, to investigate the high-speed dynamics of magnetic reconnection in solar flares; solar magnetic activity; auroral physics; magnetospheric physics; development of space technologies and small satellites; heliophysics. Acton, Canfield, DesJardins, Hellings, Kankelborg, Klumpar, Longcope, Qiu, Sample.

Atomic, Molecular, & Optical Physics. Linear and nonlinear optical laser spectroscopy; coherent optical transients; optical hole burning; Raman scattering; solid-state laser material. Babbitt, Carlsten, Cone, Craig, Leamon, Rebane.

Condensed Matter Physics. Measurements of physical properties to temperatures as low as 0.3 K; measurements of thermal expansion using a novel dilatometer capable of detecting sub-angstrom length changes of specimens to study phase transitions and critical phenomena; characterization of magnetic thin films, nanoparticles, and buried interfaces for spin-transport devices; X-ray absorption spectroscopy, magnetic circular dichroism, X-ray resonant magnetic scattering; ceramics for fuel cells fabricated and tested for their electrical properties; characterization of defects in advanced materials at the atomic level using EPR, ENDOR, and optical spectroscopy. Avci, Childs, Cone, Craig, Idzerda, Lapeyre, Leamon, Malovichko, Neumeier, Rugheimer, Schmidt, Smith.

2017 GradSchoolShopper: Graduate Programs in Physics, Astronomy, and Related Fields (ISBN: 978-0-7354-1409-9) ©2016 American Institute of Physics