COLORADO SCHOOL OF MINES

DEPARTMENT OF PHYSICS

Golden, Colorado 80401
http://physics.mines.edu

General University Information

President: Myles W. Scoggins
Dean of Graduate School: Thomas M. Boyd
University website: http://www.mines.edu
Control: Public
Setting: Suburban
Total Faculty: 338
Total Graduate Faculty: 187
Total number of Students: 5,105
Total number of Graduate Students: 1,286

Department Information

Department Chairman: Thomas Furtak
Department Contact: Barbara Johnson, Program Assistant
Total full-time faculty: 41
Total number of full-time equivalent positions: 22
Full-Time Graduate Students: 67 excluding 1st year students.
First-Year Graduate Students: 16
Female First-Year Students: 6
Total Post Doctorates: 9

Department Address

1523 Illinois Street
Meyer Hall, Room 325
Golden, CO 80401
Phone: (303) 273-3830
Fax: (303) 273-3919
E-mail: bpjohnso@mines.edu
Website: http://physics.mines.edu

ADMISSIONS

Admission Contact Information

Address admission inquiries to: David Wood
Phone: (303) 273-3853
E-mail: dmwood@mines.edu
Admissions website: http://www.mines.edu/graduate_admissions

Application deadlines

Fall admission:
U.S. students: January 15, 2012 *Int'l. students*: June 01, 2012

Application fee

U.S. students: $50 *Int'l. students*: $70
Fee is discounted for applications received prior to April 15: $50 domestic, $70 international.

Admissions information

For Fall of 2011:
Number of applicants: 101
Number admitted: 31
Number enrolled: 25

Admission requirements

Bachelor's degree requirements: Bachelor's degree in physics is required.
Minimum undergraduate GPA: 3.0

GRE requirements

The GRE is required.

Advanced GRE requirements

The Advanced GRE is recommended.

TOEFL requirements

The TOEFL exam is required for students from non-English-speaking countries.
PBT score: 600
iBT score: 215

Other admissions information

Additional requirements: The minimum acceptable score for admission has been 1,100 (verbal+quantitative) prior to 2012. The GRE physics subject exam is strongly urged, and is required for financial aid. The average GRE scores are not available.
Undergraduate preparation assumed: One semester of classical mechanics at the level of Marion, two semesters of electromagnetism at the level of Griffiths, one year of modern physics, and one semester each of thermodynamics, optics, mathematical physics, and electronics.

TUITION

Tuition year 2011–2012:
Tuition for in-state residents
Full-time students: $6,292.5 per academic term
Part-time students: $2,446.5 per academic term
Tuition for out-of-state residents
Full-time students: $13,635 per academic term
Part-time students: $5,306 per academic term
Part-time tuition is for 1 to 3.5 credit hours.
Credit hours per semester to be considered full-time: 9
Deferred tuition plan: Yes
Health insurance: Available at the cost of $1,686 per year.
Other academic fees: $934.55 per academic term
Academic term: Semester
Number of first-year students who receive full tuition waivers: 12

Teaching Assistants, Research Assistants, and Fellowships

Number of first-year
Teaching Assistants: 7
Research Assistants: 5
Fellowship students: 0
Average stipend per academic year
Teaching Assistant: $22,500
Research Assistant: $23,400
Fellowship student:

FINANCIAL AID

Application deadlines

Fall admission:
U.S. students: January 15, 2012 *Int'l. students*: June 01, 2012

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: David Wood.
Phone: (303) 273-3853
E-mail: dmwood@mines.edu
Financial aid website:
http://gradschool.mines.edu/GS-Assistantship-Policies

HOUSING

Availability of on-campus housing

Single students: Yes
Married students: Yes

For further information

Address housing inquiries to: Housing Office, Colorado School of Mines.
Phone: (800) 446-9488, x3350
Housing aid website: http://www.mines.edu/Housing_GRPR

Table A—Faculty, Enrollments, and Degrees Granted

Research Specialty	2011–2012 Faculty	Enrollment Fall 2011		Number of Degrees Granted 2011 (2007–2011)		
		Master's	Doctorate	Master's	Terminal Master's	Doctorate
Condensed Matter	9	12	29	0(1)	3(11)	2(14)
Sub-Atomic	7	6	14	1(1)	2(10)	2(9)
Optics	3	5	8	0(1)	0(6)	0(5)
Other	3	3	5	–	–	–
Total	22	26	56	1(3)	5(27)	4(28)
Full-time Grad. Stud.	–	26	52	–	–	–
First-year Grad. Stud.	–	9	10	–	–	–

GRADUATE DEGREE REQUIREMENTS

Master's: 36 semester hours in approved program with 3.0 GPA; thesis; no foreign language. 27 credit hours including thesis must be taken in residence.

Doctorate: 34 semester hours coursework, 38 of research credit. Coursework includes 12 hours in a specialty area, which include programs in Optical Science and Engineering, Photovoltaics, Nanotechnology, Materials Physics, Electromagnetics, Nuclear Physics and Astroparticle Physics in addition to topic areas in the other degree programs at CSM. Ph.D. candidacy established by grades or oral examination. Two semesters in residence are required.

Other Degrees: Interdisciplinary research is organized under centers: Renewable Energy Materials Research Science and Engineering Center (REMRSEC), Center for Microintegrated Optics for Advanced Bioimaging and Control (MOABC), Nuclear Science and Engineering Center (NUSEC), Golden Energy Computing Organization (GECO). Special solar energy related research programs are available in conjunction with the nearby National Renewable Energy Laboratory (NREL). Interdisciplinary M.S. and Ph.D. degrees are granted in Materials Science and in Nuclear Engineering.

Thesis: Thesis may be written in absentia.

SPECIAL EQUIPMENT, FACILITIES, OR PROGRAMS

The department specializes in applied physics. Available materials processing and lithography facilities provide extensive capabilities for making and characterizing nanocrystalline and amorphous semiconductors, patterned nanostructures, and self assembled nanostructures. Capabilities include growth systems (e.g., PECVD, low pressure CVD, MOCVD, sputtering, and electrochemical deposition), transmission electron microscopy and field emission scanning electron microscopy, reactive ion etching, ion implantation, wet etching and cleaning stations, oxide and nitride growth and deposition, dopant diffusion, annealing furnaces, and a clean room with optical lithography. Materials characterization capabilities include surface profilometers, visible and IR spectrometers, visible and FTIR spectroscopic ellipsometers, a complete x-ray analysis laboratory, an imaging x-ray photoelectron spectroscopy system, scanning Auger electron spectroscopy system, temperature dependent Seebeck and Hall effect systems, and characterization of photovoltaic devices and integrated circuits. Also included are an electron microprobe, an atomic force microscope, near-field microscopy, confocal and conventional Raman spectroscopy, and various chemical techniques for determining elemental compositions. Laboratories are also equipped with electron paramagnetic resonance (EPR) and nuclear magnetic resonance (NMR) as well as instruments for temperature dependent electroluminescence and photoluminescence (PL), PL excitation spectroscopy, and microwave modulated PL. The applied optics group maintains a state-of-the-art ultrafast (femtosecond) spectroscopy laboratory, including a 1 terawatt, 1 kHz, Ti:sapphire laser system, a 6 terawatt, 20 Hz, Ti:sapphire laser system used for development of novel x-ray sources, an extended cavity Ti:sapphire oscillator and a diode-pumped Nd:glass laser used for multiphoton imaging, and a fiber oscillator used for ultrafast spectroscopy and nonlinear imaging. The department's microwave and millimeter wave laboratory includes a vector network analyzer with imaging capability. The subatomic physics laboratory includes a 180 keV ion accelerator and facilities for detector development as well as laser-based atmospheric monitoring instrumentation. Faculty participate in experiments at nuclear facilities in Oak Ridge (HRIBF), Argonne (ATLAS), and at TRIMF in Vancouver. Astroparticle physics of ultra-high energy cosmic rays is studied at the Pierre Auger Observatory in Argentina. Computational physics is conducted on a massively 2144-core 268-node supercomputer with 16 GB of RAM, capable of a peak speed of 23 Tflop.

Table B—Separately Budgeted Research Expenditures by Source of Support

Source of Support	Departmental Research	Physics-related Research Outside Department
Federal government	$1,424,852	$6,166,223
State/local government		
Non-profit organizations		
Business and industry		
Other	$107,797	$1,013,844
Total	$1,532,649	$7,180,067

Table C—Separately Budgeted Research Expenditures by Research Specialty

Research Specialty	No. of Grants	Expenditures ($)
Condensed Matter Physics	72	$4,461,556
Nuclear Physics	30	$2,490,720
Optics	16	$1,398,753
Other	11	$361,634
Total	129	$8,712,663

FACULTY

Professor

Collins, Reuben T., Ph.D., California Institute of Technology, 1984. Electronic materials and devices.

Furtak, Thomas E., Ph.D., Iowa State University, 1975. Department Head. Raman spectroscopy; linear and nonlinear optical properties of materials.

Greife, Uwe, Ph.D., University of Bochum, 1994. Experimental nuclear physics and astrophysics.

Kowalski, Frank V., Ph.D., Stanford, 1978. Experimental laser physics and high-resolution spectroscopy.

Lusk, Mark T., Ph.D., California Institute of Technology, 1992. Theoretical and computational condensed matter physics.
Scales, John A., Ph.D., Colorado, 1984. Mesoscopic materials, electromagnetics, wave phenomena.
Squier, Jeff, Ph.D., Rochester, 1992. Ultrafast optics, nonlinear optics, biological imaging, microscopy, micromachining.
Taylor, P. Craig, Ph.D., Brown, 1969. Optical, electrical, and structural properties of crystalline and amorphous semiconductors.

Associate Professor

Carr, Lincoln, Washington, 2001. Theoretical condensed matter physics.
Durfee, Charles G., Ph.D., Maryland, 1994. Generation, characterization of ultrashort laser pulses, interactions with atoms and plasmas.
Ohno, Timothy R., Ph.D., Maryland, 1989. Experimental solid state physics, surface physics, photovoltaics.
Sarazin, Frederic, Ph.D., University of Caen, 1999. Experimental nuclear physics and astrophysics.
Wiencke, Lawrence, Ph.D., Columbia, 1992. Experimental particle astrophysics.
Wood, David M., Ph.D., Cornell, 1981. Solid state theory.

Assistant Professor

Toberer, Eric S., Ph.D., UCSB, 2006. Experimental materials physics.
Wu, Zhigang, Ph.D., College of William and Mary, 2002. Theoretical and computational condensed matter physics, first principles electronic structure, atomistic model simulations.

Research Professor

Arnold, Gerald B., Ph.D., UCLA, 1977. Theoretical condensed matter physics.
Coffey, Mark W., Ph.D., Iowa State, 1991. Quantum computing algorithms, superconducting and magnetic systems.
Franceschetti, Alberto, Ph.D., Scuola Internazionale Superiore di Studi Avanzati (SISSA), Trieste, Italy, 1993. Theoretical condensed matter physics.
Ginley, David S., Ph.D., MIT, 1976. Experimental materials physics.
Hollingsworth, Russell, Ph.D., Colorado State University, 1985. Experimental device physics.
Hudson, Martin, Ph.D., Florida State, 1976. Experimental nuclear physics.
Mace, Jonathan L., Ph.D., Washington State, 1990. Experimental and theoretical high energy density physics.
Shayer, Zeev, Ph.D., Tel-Aviv University, 1985. Nuclear physics and engineering.
Stradins, Pauls, Ph.D., Latvian Institute of Physics, 1990. Experimental electronic materials physics, photovoltaics.

Research Associate Professor

Beach, Joseph, Ph.D., Colorado School of Mines, 2002. Experimental materials physics, photovoltaics.
Bernard, James E., Ph.D., Delaware, 1984. Electronic materials theory.

Research Assistant Professor

Bradley, Scott, Ph.D., MIT, 2009. Experimental optoelectronics.
Flammer, P. David, M.S., Colorado School of Mines, 2001. Experimental and theoretical condensed matter physics, plasmonics.
Gray, Frederick, Ph.D., Illinois, 2003. Experimental nuclear physics.
Olson, Dana C., Ph.D., Colorado School of Mines, 2006. Experimental organic photovoltaics.
Tamboli, Adele C., Ph.D., UCSB, 2009. Experimental materials physics.

Teaching Professors and Emeritus Professors

Cecil, Edward, Ph.D., Princeton, 1972. University Professor Emeritus. Experimental nuclear physics, high-temperature fusion plasma diagnostics.
Flournoy, Alex T., Ph.D., Colorado, 2003. Teaching Associate Professor. Theoretical particle physics, string theory, and cosmology.
Kohl, Patrick, Ph.D., University of Colorado-Boulder, 2007. Teaching Associate Professor. Physics education research.
Kuo, Hsia-Po Vincent, Ph.D., University of Minnesota, 2004. Teaching Associate Professor. Physics education research.
McNeil, James A., Ph.D., Maryland, 1979. University Professor Emeritus. Theoretical nuclear physics.
Ruskell, Todd G., Ph.D., Arizona, 1996. Teaching Professor. Semiconductor surface physics.
Stone, Charles A., Ph.D., UCLA, 1990. Teaching Professor. Renewable energy science and technology.
Williamson, Don L., Ph.D., Washington, 1971. Professor Emeritus. Experimental solid state physics, Mössbauer effect, x-ray scattering.
Young, Matt, Ph.D., Rochester, 1967. Teaching Professor. Optics, metrology.

DEPARTMENTAL RESEARCH SPECIALTIES AND STAFF

Theoretical

Condensed Matter Physics. Theoretical many body quantum and classical mechanics in application to ultracold quantum gases: quantum phase transitions; atomic and molecular superfluidity and superconductivity; atom lasers; nonlinear waves; fractals, solitons, and vortices; quantum information science; mathematical physics and inverse problems; novel semiconductor materials and structures; semiconductor alloys; phonon properties; surfaces and interfaces; nanostructures; plasmonic phenomena.
Nuclear Physics. Relativistic approaches to nucleon and nuclear structure and scattering.

Experimental

Condensed Matter Physics. Semiconductor science, electronic devices, optical properties of materials and interfaces, soft condensed matter and liquid crystals, self-assembled monolayers, bio-inorganic composites, quantum nanostructures, surface physics and catalysis, transport phenomena, nonlinear optical properties of surfaces, amorphous materials.
Energy Sources & Environment. Solar photovoltaics, third-generation photoconversion, nanostructures, artificial photosynthesis, organic photovoltaics, photoelectrochemistry, optical and electronic properties of crystalline and amorphous semiconductors, thin film photovoltaic materials, photoexcitation and relaxation in nanostructures.
Nuclear Physics. Nuclear astrophysics, low energy nuclear physics, astrophysics with radioactive beams, ultra-high energy cosmic ray physics, astroparticle physics, low-energy nuclear reactions, fusion diagnostics, nuclear engineering.
Optics. Laser physics and ultrafast optical phenomena, plasmonic electronic systems, nonlinear microscopy and micromachining, ultra-high intensity lasers, ultrafast x-ray diffraction, frequency shifted feedback lasers, precision measurement, radio-frequency wave propagation in random media, ultrasonics, mesoscopic phenomena, quantum chaos.