

# WEST VIRGINIA UNIVERSITY

## DEPARTMENT OF PHYSICS AND ASTRONOMY

Morgantown, West Virginia 26506

<http://physics.wvu.edu/>

### General University Information

*President:* Gordon Gee  
*Dean of Graduate School:* Robert Jones  
*University website:* <http://www.wvu.edu>  
*Control:* Public  
*Setting:* Urban  
*Total Faculty:* 1,709  
*Total Graduate Faculty:* 1,100  
*Total number of Students:* 29,707  
*Total number of Graduate Students:* 6,880

### Department Information

*Department Chairman:* David Lederman, Chair  
*Department Contact:* David Lederman, Chair  
*Total full-time faculty:* 22  
*Total number of full-time equivalent positions:* 22  
*Full-Time Graduate Students:* 70  
*First-Year Graduate Students:* 12  
*Female First-Year Students:* 2  
*Total Post Doctorates:* 10

### Department Address

135 Willey Street  
P.O. Box 6315  
Morgantown, WV 26506  
*Phone:* (304) 293-3422  
*Fax:* (304) 293-5727  
*E-mail:* [david.lederman@mail.wvu.edu](mailto:david.lederman@mail.wvu.edu)  
*Website:* <http://physics.wvu.edu/>

### ADMISSIONS

#### Admission Contact Information

*Address admission inquiries to:* Admissions Committee, Department of Physics and Astronomy, P.O. Box 6315, Morgantown, WV 26506.  
*Phone:* (304) 293-3422  
*E-mail:* [physics@wvu.edu](mailto:physics@wvu.edu)  
*Admissions website:* <http://physics.wvu.edu>

#### Application deadlines

Fall admission:  
*U.S. students:* February 15      *Int'l. students:* February 15

#### Application fee

*U.S. students:* \$60  
A personal statement and resume are required.

#### Admissions information

For Fall of 2014:  
*Number of applicants:* 69  
*Number admitted:* 20  
*Number enrolled:* 12

#### Admission requirements

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

#### GRE requirements

The GRE is required.  
No minimum score set.

### Advanced GRE requirements

The Advanced GRE is required.

### TOEFL requirements

The TOEFL exam is required for students from non-English-speaking countries.

*PBT score:* 550

*iBT score:* 79

The minimum accepted computer-based exam (CBT) score is 213. The minimum accepted IELTS score is 6.5.

### Other admissions information

*Additional requirements:* No minimum score is specified.

*Undergraduate preparation assumed:* Intermediate mechanics, electricity and magnetism, atomic and quantum physics, thermodynamics, and mathematics through partial differential equations. Typical physics texts include Davis (mechanics), Wangsness (electricity and magnetism), McIntyre (quantum mechanics), and Sears and Salinger (thermodynamics).

### TUITION

Tuition year 2014–15:

Tuition for in-state residents

*Full-time students:* \$4,176 per semester

*Part-time students:* \$464 per credit

Tuition for out-of-state residents

*Full-time students:* \$11,079 per semester

*Part-time students:* \$1,231 per credit

Costs include University tuition, University fees, and College tuition.

*Credit hours per semester to be considered full-time:* 9

*Deferred tuition plan:* Yes

*Health insurance:* Available at the cost of \$1,497 per year.

*Other academic fees:* Fees are included in tuition numbers cited above.

*Academic term:* Semester

*Number of first-year students who received full tuition waivers:* 26

### Teaching Assistants, Research Assistants, and Fellowships

Number of first-year

*Teaching Assistants:* 10

*Research Assistants:* 2

*Fellowship students:* 2

Average stipend per academic year

*Teaching Assistant:* \$22,500

*Research Assistant:* \$22,500

*Fellowship student:* \$28,000

Teaching assistantships guaranteed to all incoming first year students. Fellowships in specific fields are available; contact faculty or go to <http://grad.wvu.edu/funding/fellowships>.

### FINANCIAL AID

#### Application deadlines

Fall admission:

*U.S. students:* February 15      *Int'l. students:* March 15

Spring admission:

*U.S. students:* November 1      *Int'l. students:* November 1

Loans

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

For further information

Address financial aid inquiries to: Graduate Program Committee  
Department of Physics and Astronomy, West Virginia University, Morgantown, WV 26506-6315.  
Phone: (304) 293-3422  
E-mail: david.lederman@mail.wvu.edu  
Financial aid website: [http://grad.wvu.edu/financial\\_assistance](http://grad.wvu.edu/financial_assistance)

HOUSING

Availability of on-campus housing

Single students: Yes  
Married students: Yes

For further information

Address housing inquiries to: University Apartments, PO Box 6430, Morgantown, WV 26505.  
Phone: (304) 293-5840 or (304) 293-054e  
E-mail: wvumedcenterapt@mail.wvu.edu  
Housing aid website: [http://housing.wvu.edu/graduate\\_student\\_faculty\\_and\\_staff\\_housing](http://housing.wvu.edu/graduate_student_faculty_and_staff_housing)

Table A—Faculty, Enrollments, and Degrees Granted

Research Specialty	2014–15 Faculty	Enrollment Fall 2014		Number of Degrees Granted 2013–2014 (2008–14)		
		Mas-ter's	Doc-torate	Mas-ter's	Terminal Master's	Doc-torate
Astrophysics	5	–	16	2(7)	–	5(6)
Chemical Physics	1	–	–	–	–	–(1)
Condensed Matter Physics	9	–	32	2(14)	–(4)	3(24)
Fluids, Rheology	1	–	–	–(2)	–	1(1)
Medical, Health Physics	2	–	–	–(2)	–	–
Physics and other Science Education	3	–	1	–	–	–
Plasma and Fusion	6	–	14	1(12)	–(1)	4(8)
Statistical & Thermal Physics	2	–	1	–(1)	–	–(1)
Total	22	–	64	5(38)	–(5)	13(36)
Full-time Grad. Stud.	–	–	78	–	–	–
First-year Grad. Stud.	–	–	12	–	–	–

GRADUATE DEGREE REQUIREMENTS

**Master's:** Approved courses with a minimum GPA of 3.0 is required. There is no residence or language requirement. For a degree with thesis, 24 credits are required. For a degree without a thesis, 30 credits are required.  
**Doctorate:** A minimum of 36 hours of course work in an approved program with a minimum GPA of 3.0 are required. A written comprehensive exam, oral research exam, dissertation, and oral dissertation defense are required.  
**Thesis:** Thesis may be written in absentia.

SPECIAL EQUIPMENT, FACILITIES, OR PROGRAMS

The department and associated instrument and electronics shops are housed in White Hall, a six-story building located on the downtown campus. The building renovation was completed in

2011 and houses a 60-seat planetarium, a roof-top observatory, a small radio telescope, and 23 state-of-the-art research laboratories.

The plasma facilities include a triple plasma source, a Q-machine for generating space-like plasmas and waves, two helicon plasma sources, a space simulation chamber, a plasma processing test facility, four laser facilities dedicated to plasma diagnosis, a toroidal experiment for turbulence studies, and a pulsed high-velocity plasma source.

The condensed matter physics facilities include four molecular beam epitaxy (MBE) growth facilities, magnetic resonance laboratory (EPR, ENDOR), SQUID magnetometer with magneto-resistance probe, QD PPMS system, rotating anode x-ray source, x-ray diffractometers, an e-beam writer, a scanning probe microscope, an atomic force microscope, Hall effect apparatus, an optical spectrophotometer, an FTIR spectrophotometer, a high-temperature graphite furnace, ultrasonic, thermogravimetry, and differential scanning calorimetry; characterization capabilities for thermoluminescence, optical absorption, photorefectance, photo-conductance, and photoluminescence of materials, two-dimensional Fourier transform spectroscopy, second harmonic generation system for interface studies, and a sputtering system for thin-film deposition.

Laser facilities include four cw argon ion lasers, three dye lasers, three tunable diode lasers, three cw and Q-switched Nd:YAG lasers, and three femtosecond lasers.

Departmental computing facilities include two dedicated cluster facilities for development of new computational resources and two large computer clusters. Cooperative research programs with National Energy Technology Laboratory and Pittsburgh Super-computing Center are possible. University-wide shared research facilities that include sophisticated materials characterization and device fabrication tools, as well as high-performance computing, are available (<http://sharedresearchfacilities.wvu.edu>). A nano-technology program focusing on bionanotechnology (Nano-SAFE, <http://nanosafe.wvu.edu>) engages students in interdisciplinary research. A comprehensive astrophysics program, teaming with the National Radio Astronomy Observatory in Green Bank, WV, gives students the opportunity to work with a wide array of world-class researchers in the field (<http://astro.wvu.edu>).

Table B—Separately Budgeted Research Expenditures by Source of Support

Source of Support	Departmental Research	Physics-related Research Outside Department
Federal government	\$5,000,000	
State/local government	\$500,000	
Non-profit organizations	\$100,000	
Business and industry		
Other		
Total	\$5,600,000	

Table C—Separately Budgeted Research Expenditures by Research Specialty

Research Specialty	No. of Grants	Expenditures (\$)
Astrophysics	10	\$1,500,000
Condensed Matter Physics	18	\$2,600,000
Plasma and Fusion	10	\$2,000,000
Total	38	\$6,100,000

**FACULTY****Professor**

- Abdul-Razzaq**, Wathiq, Ph.D., University of Illinois at Chicago, 1986. *Condensed Matter Physics, Physics and other Science Education*. Experimental solid state; magnetism of nanoparticles; particulate matter in the environment.
- Golubovic**, Leonardo, Ph.D., University of Belgrade, 1987. *Condensed Matter Physics, Statistical & Thermal Physics*. Condensed matter theory and statistical physics.
- Koepke**, Mark E., Ph.D., University of Maryland, 1984. *Atmosphere, Space Physics, Cosmic Rays, Plasma and Fusion*. Experimental plasma physics; nonlinear dynamics.
- Lederman**, David, Ph.D., University of California, Santa Barbara, 1992. Robert L. Carroll Professor of Physics. *Condensed Matter Physics, Materials Science, Metallurgy, Nano Science and Technology*. Experimental solid state physics; magnetic materials; bioelectronics.
- Lewis**, James, Ph.D., Arizona State University, 1996. *Chemical Physics, Condensed Matter Physics, Materials Science, Metallurgy*. Computational physics.
- Lorimer**, Duncan R., Ph.D., University of Manchester, 1994. *Astronomy, Astrophysics*. Radio astronomy; astrophysics.
- McLaughlin**, Maura A., Ph.D., Cornell University, 2001. *Astronomy, Astrophysics*. Radio astronomy; astrophysics.
- Scime**, Earl E., Ph.D., University of Wisconsin-Madison, 1992. Oleg Jefimenko Professor of Physics and Astronomy, Interim Associate Vice President for Research. *Applied Physics, Atmosphere, Space Physics, Cosmic Rays, Plasma and Fusion*. Experimental plasma physics.
- Stewart**, Gay, Ph.D., University of Illinois, 1994. Eberly Professor of STEM Education, Flexible Education Research Network (FERN) initiative leader. *Physics and other Science Education*. STEM education, graduate student training.

**Associate Professor**

- Cassak**, Paul, Ph.D., University of Maryland, 2006. *Plasma and Fusion*. Theoretical plasma physics.
- Pisano**, Daniel J., Ph.D., University of Wisconsin-Madison, 2001. *Astronomy, Astrophysics*. Radio astronomy; astrophysics.
- Romero**, Aldo H., Ph.D., University of California, San Diego, 1998. *Computational Physics, Condensed Matter Physics, Nano Science and Technology, Theoretical Physics*.
- Stewart**, John, Ph.D., University of Illinois, Urbana-Champaign, 1994. *Physics and other Science Education*. Physics Education Research.

**Assistant Professor**

- Anderson**, Loren, Ph.D., Boston University, 2009. *Astronomy, Astrophysics*. Observational astrophysics.
- Bristow**, Alan, Ph.D., University of Sheffield, 2003. *Condensed Matter Physics, Optics*. Experimental condensed matter physics; optics.
- Cen**, Cheng, Ph.D., University of Pittsburgh, 2010. *Applied Physics, Condensed Matter Physics, Materials Science, Metallurgy, Nano Science and Technology*. Novel complex oxide-based material systems.
- Flagg**, Edward, Ph.D., University of Texas-Austin, 2008. *Nano Science and Technology, Optics, Quantum Foundations*. Quantum optics.
- Holcomb**, Mikel, Ph.D., University of California - Berkeley, 2009. *Condensed Matter Physics, Materials Science, Metallurgy, Nano Science and Technology, Optics, Solid State Physics, Surface Physics*. Multiferroic materials and interfaces.

**McWilliams**, Sean, Ph.D., University of Maryland, 2008. General relativity. *Astronomy, Astrophysics*. Gravitational wave theory.

**Schulze**, Julian, Ph.D., Ruhr-University Bochum, 2009. *Plasma and Fusion*. Experimental plasma physics.

**Stanescu**, Tudor, Ph.D., University of Illinois at Urbana-Champaign, 2002. *Condensed Matter Physics*. Theoretical condensed matter physics.

**Emeritus**

- Halliburton**, Larry E., Ph.D., University of Missouri, Columbia, 1971. *Applied Physics, Condensed Matter Physics, Materials Science, Metallurgy, Optics*. Optical and magnetic properties of point defects.
- Pavlovic**, Arthur S., Ph.D., Pennsylvania State University, 1966. *Condensed Matter Physics*. Solid state physics experiments.
- Treat**, Richard P., Ph.D., University of California, Riverside, 1967. Quantum field theory.
- Weldon**, H. Arthur, Ph.D., Massachusetts Institute of Technology, 1974. *Particles and Fields*. Particle theory.

**Research Professor**

- Demidov**, Vladimir, Ph.D., St. Petersburg State University, 1981. *Plasma and Fusion*. Experimental plasma physics.
- Seehra**, Mohindar S., Ph.D., University of Rochester, 1969. *Applied Physics, Condensed Matter Physics*. Solid state experiment; x-ray scattering; applied physics; magnetism.

**Research Assistant Professor**

- Borisov**, Pavel, Ph.D., University of Duisburg-Essen, 2009. *Condensed Matter Physics, Materials Science, Metallurgy, Nano Science and Technology, Solid State Physics*. Complex oxide materials, multiferroic thin films and heterostructures.
- Glinka**, Yuri D., Ph.D., Shevchenko State University, 1989. *Condensed Matter Physics, Materials Science, Metallurgy, Nano Science and Technology, Optics, Solid State Physics*. Ultra-fast optical spectroscopy.
- Keesee**, Amy M., Ph.D., West Virginia University, 2006. *Atmosphere, Space Physics, Cosmic Rays, Plasma and Fusion*. Space plasma physics; optical diagnostics of plasmas.

**Teaching Assistant Professor**

- Miller**, Paul, Ph.D., West Virginia University, 2009. *Physics and other Science Education, Plasma and Fusion*. Physics education.

**Adjunct Professor**

- Fraye**, D., Ph.D., University of Virginia, 1996. Extragalactic astronomy.
- Ganguli**, Gurudas, Ph.D., Boston College, 1980. *Plasma and Fusion*. Plasma physics theory.
- Lockman**, Felix J., Ph.D., University of Massachusetts, 1979. Galactic and extragalactic radio astronomy.
- O'Neil**, K., Ph.D., University of Oregon, 1997. Extragalactic radio astronomy.
- Raylman**, Raymond R., Ph.D., University of Michigan, 1991. *Medical, Health Physics, Nuclear Physics*. Medical physics; radiology; imaging.
- Rosen**, R., Ph.D., University of North Carolina, 2007. White dwarf and Pulsar astronomy.
- Smith**, Duane, Ph.D., University of Chicago, 1970. *Statistical & Thermal Physics*. Statistical and applied physics; fluids.

**DEPARTMENTAL RESEARCH SPECIALTIES AND STAFF****Theoretical**

Applied Physics. Photocatalytic materials, new materials by design. Lewis, Romero.

Astrophysics. Interstellar medium; galactic structure; stellar evolution; compact objects; general relativity; pulsars. Anderson, Lorimer, McLaughlin, McWilliams, Pisano.

Condensed Matter Physics. Surface and interface phenomena; lattice stability and relaxation; molecular dynamics; properties of disordered materials; biomaterials; complex fluids and membranes; fracture; transport in random media; thin-film growth; optical properties of materials. Abdul-Razzaq, Borisov, Bristow, Cen, Flagg, Glinka, Golubovic, Holcomb, Lederman, Lewis, Romero, Stanescu.

Plasma and Fusion. Plasma instabilities; simulations applicable to space and laboratory plasmas; low-temperature plasmas; fusion diagnostics; space plasma instrumentation; space plasma modeling and data analysis. Cassak, Ganguli, Keese, Koepke, Schulze, Scime.

Statistical & Thermal Physics. Fractals; percolation theory; chaos; phase transitions and critical phenomena; nonequilibrium growth and pattern formation. Golubovic, Lederman, Smith.

### Experimental

Applied Physics. Preparation and characterization of nanoparticles; iron-based catalysts; properties of air-borne particulate matter; coal-based high-purity carbons and carbon fibers; electrochemical detection of Hg and other trace metals using boron-doped diamond films; visible and UV light emitters and sensors; nonlinear optical and photorefractive materials. Bristow, Flagg, Halliburton, Lederman, Seehra.

Astrophysics. Radio astronomy; x-ray astronomy; pulsars; tests of strong-field gravity; digital signal processing; computational astrophysics. Anderson, Frayer, Lockman, Lorimer, McLaughlin, McWilliams, O'Neil, Pisano, Rosen.

Condensed Matter Physics. Electronic structure and magnetic properties of artificially grown surfaces and superlattices and nanoscale particles; spin transport; properties of magnetic ions and clusters; elementary excitations in antiferromagnets; magnetic susceptibility; magnetostriction; electrical, structural, and electro-optic properties of semiconductors; optical and magnetic resonance characterization of point defects. Abdul-Razzaq, Borisov, Bristow, Cen, Flagg, Glinka, Golubovic, Halliburton, Lederman, Pavlovic, Seehra.

Materials Science, Metallurgy. X-ray scattering from disordered systems; Auger and x-ray photoelectron spectroscopy deposition physics; molecular beam epitaxy; properties of monolayer and multilayer thin films; optical properties of quantum-confined systems and semiconductors. Borisov, Holcomb, Lederman, Seehra.

Nano Science and Technology. Nanostructured materials; nanotoxicology; biological sensors; nanomagnetism; quantum dots. Borisov, Bristow, Cen, Flagg, Glinka, Holcomb, Lederman, Seehra, Stanescu.

Physics and other Science Education. K-12 teacher training; development of GTA training programs; curriculum development. Abdul-Razzaq, Keese, Miller, Gay Stewart, John Stewart.

Plasma and Fusion. Plasma waves and instabilities; nonlinear interactions; turbulence and chaos; space plasma instrument design; space plasma data analysis and instrument (sensor) development; magnetic reconnection; plasma processing. Demidov, Ganguli, Keese, Koepke, Miller, Schulze, Scime.

**View additional information about this department at  
[www.gradschoolshopper.com](http://www.gradschoolshopper.com)**