

The Westmont College Physics Department at a glance ...

Mission Statement

The mission of the Westmont Physics Department is to prepare students majoring in Physics and Engineering/Physics for graduate school and careers in physics, engineering, education, and other professional fields by helping them develop both experimental and theoretical skills in classical and modern physics with opportunities for research and internships. We seek to serve students in other majors by providing challenging courses in physics and astronomy to encourage interest in and understanding of the principles, methods and concepts of the physical sciences. We explore with all of our students the interactions of faith and science with the goal of enabling each student to communicate a mature worldview that incorporates both.

Faculty and Staff

Dr. Kenneth Kihlstrom - professor of physics. B.S. physics, Stanford University, PhD physics, Stanford University. Areas of specialty: low temperature superconductivity (kihlstrom@westmont.edu)

Dr. Warren F. Rogers - professor of physics. B.S. physics, Harvey Mudd College, PhD physics, University of Rochester. Areas of specialty: nuclear physics, cosmic muons, astronomy (rogers@westmont.edu)

Dr. H. Michael Sommermann - professor of physics. Vor-Diplom, Universität Würzburg, PhD physics, State University of New York, Albany. Areas of specialty: theoretical nuclear physics, astronomy (sommermann@westmont.edu)

Dr. Tom Whittemore - adjunct professor of physics and lab coordinator. B.S. physics, Purdue University, PhD physics, University of Arizona. Areas of specialty: astronomy, mirror making, telescope construction (whittemore@westmont.edu)

Ms. Silvia Rodarte - departmental administrative assistant (805-565-6389, srodarte@westmont.edu)

Degree Options

B.S. and B.A. degrees in Physics - provides a solid foundation for graduate study in physics doctoral programs, in engineering masters and doctoral programs, and for a variety of careers including, among others, teaching (high school, college, university), research scientist, science writing, patent law, software development, materials research, nuclear medical science, and forensic science.

B.S and B.A degrees in Engineering Physics - prepares students for engineering masters programs (mechanical, electrical, process, civil, aeronautical, etc.), provides technical skills needed in a variety of careers such as engineering, medicine, law, secondary or college-level teaching, technical writing, patent work, geophysical or marine exploration, and medical technology.

3-2 Engineering dual-degree program - combines a three-year Westmont liberal arts and sciences curriculum with two years of additional study at an accredited engineering institution. Students receive two degrees, a formal engineering degree from the engineering institution and a B.A. in engineering physics from Westmont. A sampling of schools at which students have completed their engineering degrees include USCB, USC, University of Washington, Boston University, Stanford, and Washington University in St. Louis.

Research Opportunities

One of the benefits of a small liberal arts college setting is the small class sizes and opportunity to really get to know your professors in and out of class. Another benefit is for students to have opportunity to get involved in research projects with faculty, during the school year and over the summer. Research opportunities for Westmont students also exist in the Santa Barbara area, and around the country.



Figure 1: *The Westmont College Keck Telescope*

Research opportunities are available in Astronomy (using the Westmont Keck Telescope), Experimental Nuclear Physics (conducted at Westmont College and at Michigan State University), Cosmic Muon Physics (at Westmont College), and Low Temperature Superconductivity (at Superconducting Technologies, Inc.).

Astronomy - In 2005 Westmont College was awarded a large grant from the W.M. Keck Foundation to replace its former 16" reflecting telescope, built by George Carroll in the late 1950's, with a state-of-the-art 24" research-grade Ritchey-Cretien Cassegrain reflecting telescope. The new instrument is currently housed in the campus's new observatory, recently constructed as part of the first phase of the Westmont Campus Master Plan. Research opportunities for students are available in a number of areas in astronomy, including astrophotography, variable star light curve analysis, near-Earth object studies, extra-galactic supernovae searches, to name a few. Interested students should contact Dr. Michael Sommermann.



Figure 2: *The Globular Cluster in Hercules*

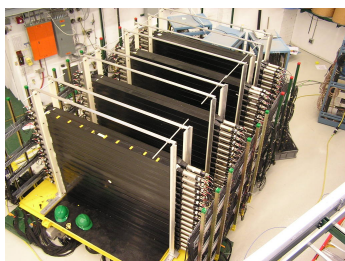


Figure 3: *The Modular Neutron Array (MoNA) at NSCL, MSU*

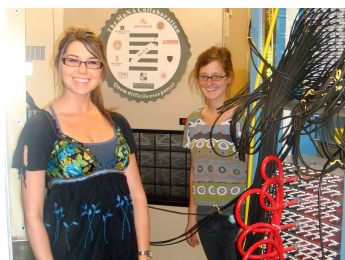


Figure 4: *Westmont Students at the NSCL, MSU*

Experimental Nuclear Physics - Study of Exotic Nuclei - Westmont physics students can participate in summer research with Dr. Rogers, conducted jointly at Westmont College and at Michigan State University. In 2002, funded by an NSF Major Research Instrumentation (MRI) program, Westmont College students participated in the construction, testing, and calibration of 16 large scintillation detectors that were designed to be part the large 144-detector Modular Neutron Array (MoNA, <http://www.cord.edu/dept/physics/mona>), now housed at the National Superconducting Laboratory at Michigan State University. During the summers Westmont students travel with Dr. Rogers to the NSCL at MSU to participate in experiments using MoNA to investigate the properties of exotic neutron-rich nuclei along with other undergraduate students and scientists from the 8 other collaborating institutions. The Westmont College Cosmic Muon Detector Array, modeled after MoNA array, uses the same electronics and software packages, and therefore students working with the CMDA receive excellent training for participation in experiments at the NSCL. Data analysis following these experiments can be conducted at Westmont College using a data server maintained by Indiana University, South Bend. Westmont College was recently awarded another MRI grant to contribute to the construction of an additional detector array as supplement to MoNA, in which Westmont students will once gain get involved. Interested students should contact Dr. Rogers.

Cosmic Muon Detector Array (CMDA) - The Westmont College CMDA, constructed by undergraduate physics students, consists of 8 position sensitive charged-particle scintillation detectors arranged in a configuration designed to provide wide-angle imaging of the distribution of cosmic muon flux over a wide angular range in the sky. High energy muons, the heavy elementary particle cousins of the electron, are produced high in the upper atmosphere by the bombardment of high energy primary cosmic with air molecules. The muons travel down to the surface of the earth and eventually stop in the earth's crust. The CMDA is designed to monitor the directionality of the muons as they reach the earth's surface. It is also designed to monitor changes in the overall flux as a function of time, dependent on such things as sunspot activity and barometric changes in the atmosphere, as well as changes in the directionality of the muons over time. Interested students should contact Dr. Rogers.



Figure 5: *Westmont College Cosmic Muon Detector Array (CMDA)*

Low Temperature Superconductivity - Students have participated in research at Superconductor Technologies in Goleta (about 20 minutes from campus). The research involves work on tunable superconducting filters at RF frequencies. Superconductors are materials that lose all resistance to electricity at low temperatures. Using superconductors to make filters results in the ability to make very sharp filters that has applications in cellular technology (filters for wireless base stations) as well as secure communications. By using varactors (variable capacitors) high speed (under a microsecond) tunability over a broad frequency range is possible. The work has primarily been supported by contracts with DARPA. A number of students have been able to be involved through paid internships at STI. Interested students should contact Dr. Kihlstrom.

NSF Research Experience for Undergraduates Program - Opportunities for undergraduate summer research at other colleges and universities around the country are available through the National Science Foundation's "Research Experience for Undergraduates" program. Several programs are available for application each summer, and students are admitted on a competitive basis. Information on programs available in physics and in engineering can be found at <http://www.nsf.gov/crssprgm/reu/>

Student Presentations Locally and Nationally

Westmont physics and engineering students who have participated in research have opportunity to present their work, both locally and nationally. The *Celebration of Summer Research* is held at the beginning of each academic year and showcases student accomplishments over the previous summer. This event has traditionally focused on work in the natural and behavioral sciences. Additionally the *Student Research Symposium* (<http://physics.westmont.edu/symposium/>) is held each spring semester, designed to showcase students' accomplishments in research over the entire year, and includes students from each of the three academic divisions, the Natural and Behavioral Sciences, the Social Sciences, and the Humanities. Students also have opportunity to present their research at professional conferences. For example, Westmont students participating in experimental nuclear physics research have participated in the yearly conferences of the Division of Nuclear Physics of the American Physical Society in a program specifically designed for undergraduate students from around the nation that have participated in nuclear science, called the *Conference Experience for Undergraduates*. This program has been held annually for 12 years, and over 1000 students from around the nation have participated, including several Westmont students.



Figure 6: Conference Experience for Undergraduates (CEU)

Internship Opportunities

Several internship opportunities are also available in the Santa Barbara area, including at organizations such as Raytheon, Santa Barbara Instruments Group, Superconductor Technology, Inc., and Cottage Hospital, to name a few. These are great off-campus, part-time, major-specific opportunities to participate in a work-learning arrangement that complements course study on campus and helps students learn what the working environment in their field can involve.