RISE ABOVE THE CROWD...

Major in Physics at UMass Dartmouth
Physicists can do pretty much anything. Our training can be applied to almost any activity, and it allows us to see things in ways that might not be obvious to others.

– Simon Singh, science writer

Why do stars shine?

Why do airplanes fly?

Why do cell phones work through solid walls?

If you find yourself pondering these sorts of “WHY?” questions, you have the makings of a physicist. Physicists uncover the mysteries of nature, from subatomic particles to galaxies, from cosmic strings to black holes, from the ocean depths to the farthest reaches of space. Research in physics paved the way for lasers, solar cells, electric cars, medical diagnostics, computers, even the Internet itself. Physicists lead major technology companies and research institutes, expanding the frontiers of knowledge and meeting our planet’s environmental challenges. Join us and become part of this exciting enterprise to the future.
The voyage of discovery lies not in seeking new horizons, but in seeing with new eyes.

– Marcel Proust

For more than forty years, the UMass Dartmouth Physics Department has served students with a passion to explore the physical world, students seeking to follow generations of scientists asking that fundamental question: “WHY?”

We offer the Bachelor of Science Degree in Physics and the Bachelor of Science Degree in Physics with Astronomy/Astrophysics Option. The technical skills you will acquire along the way – critical thinking, problem solving, mathematical analysis, computer simulation, technical writing – prepare you for an exciting career in many areas of theoretical and applied science, plus allied fields such as environmental science, engineering, computers, and medicine. UMass Dartmouth graduates pursue advanced studies in our own Master’s degree program or in Ph.D. programs nationwide; assume leadership roles in industry, business, and government; become faculty members at colleges and universities; design and evaluate computer systems; create technology companies; or teach science at schools throughout the Commonwealth.

According to the Bureau of Labor Statistics, careers in physics are projected to grow at a faster than average rate over the next decade. A 2009 survey by the National Association of Colleges and Employers shows that the starting salaries of physics graduates generally exceed those of graduates in other fields, including marketing, accounting and even finance.
The UMass Dartmouth Physics Department is a close-knit community of faculty and student scholars. We offer a comprehensive program of study that covers all the core fields of physics: classical and quantum mechanics, electricity and magnetism, modern physics and relativity, optics, thermodynamics, and solid state physics, with ample opportunity to investigate related fields like astrophysics, weather and climate, ocean science, and environmental physics. We also teach advanced laboratory techniques as well as computer simulation and numerical modeling.

You will experience the thrill of discovery by working alongside faculty members in research projects. Our students have investigated undersea currents on an oceanographic research vessel off the coast of Japan, peered through mountaintop telescopes in Arizona, pierced the atomic nucleus at a giant particle accelerator in Sweden, and searched for ripples in spacetime at the futuristic Laser Interferometer Gravitational Wave Observatory in Louisiana. Our students routinely present results of their research at professional conferences nationwide. And they plan regular social and service activities through the campus chapter of the Society of Physics Students.

**Advances are made by answering questions. Discoveries are made by questioning answers.**

– Bernard Haisch, astrophysicist
Nature uses only the longest threads to weave her patterns, so each small piece of her fabric reveals the organization of the entire tapestry.

The Physics Department has established itself as a leader in scientific computing. Faculty and students have access to some of the most powerful research supercomputers on the planet, including Argonne National Laboratory’s Intrepid, currently the eighth-fastest supercomputer in the world. On site, the department maintains its own supercomputers, featuring an ultra-fast 88-core Beowulf cluster, used to simulate star formation and explosions; plus a groundbreaking high-performance supercomputer utilizing sixteen Sony Play Station 3 processors, used to model gravity waves from colliding black holes. The department also operates a fully-equipped observatory with a 16-inch computer-controlled telescope and CCD imaging camera.
Meet the UMass Dartmouth Physics Department

Robert Fisher

Dr. Fisher comes to UMass Dartmouth with degrees from Caltech and Berkeley, plus a research scientist position at the University of Chicago. His sophisticated computer simulations provide a front-row seat on the formation and eventual destruction of stars. Incorporating the latest mathematical theories about the turbulent flow of gases, Dr. Fisher applies the massive number-crunching power of the nation’s fastest supercomputers to generate accurate visualizations of the stellar explosions that produce black holes. He recently received a $200,000 National Science Foundation grant to assemble an advanced supercomputer right on our campus for use by researchers in physics, math and engineering. To see some of Dr. Fisher’s amazing visualizations, visit his research website: http://www.novastella.org/.

Alan Hirshfeld

Dr. Hirshfeld, an astronomer, is a specialist in the history of physics and astronomy. He has written books (http://www.amazon.com/-/e/B001HN9DD4) and numerous magazine articles that chronicle the epic saga of astronomers who tried to measure the first distance to a star, the transformation of classical astronomy into modern astrophysics, the influence of photography and spectroscopy on astronomical observation, as well as the life and work of the notable scientists Michael Faraday and Archimedes. Dr. Hirshfeld is also the director of our Observatory, which is equipped with a modern 16-inch, computer-controlled telescope and electronic CCD camera. In addition, he supervises our department’s physics-teacher training program.

Jong-Ping Hsu

Mention the word *spacetime* or *gravity* or *relativity* and the first name that pops into mind is Albert Einstein. True, Einstein’s theories remain the foundation of our understanding of these subjects. But theoretical physicists such as Dr. Hsu continually test knotty details of Einstein’s theories, and on occasion propose possible variations to mainstream ideas about cosmology. Dr. Hsu has written a raft of research papers and a number of books covering some of the most exciting areas of theoretical physics: gravity, relativity, field theory, quantum mechanics, and quantum computing. For the mathematically inclined, working side by side with Dr. Hsu opens a window onto the inner workings of our universe. But Dr. Hsu also has interests that lie closer to home: he and his students regularly serve as judges at school science fairs across the state.
Born out of titanic stellar implosions, black holes exert a gravitational pull so strong that even light cannot escape their powerful grasp. Dr. Khanna lifts the veil on black holes by mathematically simulating the spacetime ripples—gravity waves—radiated by these cosmic wonders as they gobble up neighboring stars or collide with one another. Dr. Khanna’s students have worked alongside scientists at the futuristic Laser Interferometer Gravitational Wave Observatory in Louisiana searching for these gravity waves. His research has received widespread recognition (http://gravity.phy.umassd.edu), in part because of the unusual way that he churns through his complex calculations: using an ultrafast, home-built supercomputer consisting of graphics processing units from popular gaming systems, such as Sony PlayStation 3. His website on high-performance scientific computing (http://hpc.sf.net/) has had more than a million hits since 2005!

Grant O’Rielly

Dr. O’Rielly explores nature’s subatomic realm using giant particle accelerators at Jefferson Laboratory in Virginia and at Lund University in Sweden. These multimillion-dollar behemoths fire beams of high-speed electrons at atomic nuclei, releasing a host of minuscule particles. But Dr. O’Rielly’s students don’t just hear about his experiments in the classroom, they accompany him—all-expenses paid—to Virginia and to Sweden to operate the detectors that reveal the inner workings of the atom. Back home, they help analyze the experimental data and produce results that are published in major physics journals. Besides being a research scientist, Dr. O’Rielly is an innovator in physics teaching. He was recently awarded a National Science Foundation grant to assess the use of in-class, electronic personal response system “clickers” to track students’ understanding of physics concepts in real time.

Amit Tandon

Earth’s oceans are critical to our ecosystem, affecting climate and the environment. While not obvious to the eye, different regions of the ocean constantly intermix, altering temperature, density, and biological diversity in complex ways. Dr. Tandon and his students compare mixing patterns observed by buoys and satellites to what is predicted by theories of fluid mechanics. One student recently spent several weeks on a scientific cruise in the sea off Japan. This vital research, funded by grants from the National Science Foundation, Office of Naval Research, and NASA, has appeared in prestigious oceanography and meteorology journals worldwide. Details can be found at Dr. Tandon’s website: http://oceanphysics.blogs.umassd.edu/. A dedicated teacher, Dr. Tandon helped develop a rotating water tank to demonstrate atmosphere- and ocean-mixing patterns in his own classroom and in community presentations. See the apparatus in action at http://www.youtube.com/user/WeatherInATank and at http://www-paoc.mit.edu/labguide/index.html.
What happens when a beam of light illuminates an atom? Or a high-speed ion barges into a molecule? Or a pair of electrons strays near a nucleus? Starting from fundamental ideas of physics, Dr. Wang devises computational and numerical modeling techniques to calculate or simulate sub-microscopic processes that take place in the atomic-molecular realm. He collaborates with scientists internationally and invites students to explore with him this essential frontier of physics. Dr. Wang also studies the effect of ultra-short laser pulses on atoms, a promising research area that has received much press lately. And he has revived interest in the possible scientific uses of a nearly forgotten mathematical function developed in the 18th century. In addition to teaching advanced physics classes, he Dr. Wang one of our most popular teachers of the introductory course on the principles of force and motion.

Remember the last time you got stuck in traffic on the highway, only to find the backup mysteriously disappear? Or missed an appointment because the bus showed up late? Such aggravations are the target of research by Dr. Zarrillo, an internationally recognized physicist in the field of transportation engineering. Dr. Zarrillo develops advanced software tools used by transportation departments nationwide to create safer and more efficient highway systems. Locally, she and her students have optimized a non-profit organization's transportation service, tracked campus shuttle vans and regional buses using GPS technology, and studied the impact of cell phone usage on driving performance. Dr. Zarrillo exemplifies the interdisciplinary scientist, who brings together diverse scientific and technological disciplines to help solve societal problems. Even with a full schedule of research and student mentoring, she enjoys teaching freshman physics classes in electricity and magnetism.

For students pursuing a career in astronomy, our B.S. degree Option in Astronomy/Astrophysics provides both an essential foundation in basic physics plus courses and practical training in the observational and analytical methods astronomers use to study the cosmos. This option program is an ideal route to graduate study in astronomy.
What UMass Dartmouth Physics Graduates Have To Say…

- "I use the basics – mechanics, electronics, electromagnetism – every day in my work. Corporations value employees with this knowledge."
- "I've used my background in physics to develop software that developers use to analyze retail markets."
- "Experience in physics proved to be an excellent preparation for MBA studies and work."
- "Physics gave me a good background for the computer/engineering courses I subsequently took."
- "I participate as a researcher doing cutting-edge work in the laser light damage industry."
- "My physics background was a big help for graduate study in electrical engineering."
- "The small class sizes I encountered in the Physics Department created a superior atmosphere for learning."
- "I liked working closely with the faculty, especially helping them in their research."
- "My experience at UMass Dartmouth was a wonderful journey. Looking back on this journey, the Physics program helped me to understand things around me and gave life to my dreams."
The Physics Department at UMass Dartmouth...