

# Fundamentally Physical

MAJOR  
Physics

[www.stolaf.edu/depts/physics](http://www.stolaf.edu/depts/physics)



*“Physics is an excellent course of study for anyone who is curious about how things work. If you like understanding how the solar system and galaxies are organized, how rainbows work or how learning to manipulate atoms leads to new technologies, then physics is for you.”*

—David Nitz '73  
Professor of Physics

**A**stronomy. Medicine. Law. Engineering. Business. Computer science. Architecture. Some of the careers for which physics prepares students might seem surprising. Physics is the study of how and why things work — from the minute world of the atomic nucleus to the vast universe itself — within the context of a few fundamental laws. The discipline can open doors to numerous fields of study, with its rich foundation in analytical problem-solving and experiment-based investigation.

“Physics provides a practical, hands-on experience because it’s about observation and working in the lab,” explains Professor of Physics David Nitz, who specializes in atomic and molecular physics. “But it is also analytical. It teaches logic and problem solving, and those skills are transferable to lots of different careers. The laws of physics are applied in other sciences, so it also supports an education in chemistry, biology, or engineering.”

Nitz says his 1973 undergraduate degree in physics from St. Olaf has held up nicely over the years. “When I got to graduate school, many of my classmates had come from larger universities, where they had taken more physics courses,” he says. “But I appreciated the broader liberal arts background, coupled with opportunities for research and a strong lab program.”

That holds true today. “Our program has a strong focus on hands-on experience in the laboratory, giving our majors exposure to experimental methods and techniques beyond the norm,” says Professor of Physics Robert Jacobel, who chairs the physics department. “The opportunities for involvement with faculty in their research are exceptional, too.”

Jacobel, one of the few scientists to have an Antarctic glacier named after him, leads the St. Olaf Center for Geophysical Studies of Ice and Climate (CEGSIC), a National Science Foundation-sponsored research project that utilizes satellite and ground-based remote sensing techniques to explore changes in ice dynamics and the evolution of the earth’s ice sheets.

## Cool Class

### Origins of Nuclear Weapons

The world hasn’t been the same since the United States dropped nuclear bombs on Hiroshima and Nagasaki to end World War II. Part physics and part history, the class allows students to explore the scientific developments and the political, social, military and psychological environment that produced the bomb that continues to impact world events.

Current student research includes ice and volcano interactions on Mount Veniaminof, Alaska; englacial water conduit studies at Storglaciären in arctic Sweden; studies of the fast ice streams in West Antarctica; and traversing Antarctica with the International Trans-Antarctic Scientific Expedition.

**IT’S A FACT: We are 6th among 217 baccalaureate liberal arts colleges nationwide in the number of graduates who go on to earn Ph.D.s in physics.**

Today, with the need for scientists to probe challenging global problems, students must be experienced in collaborative, interdisciplinary approaches to research. Projects such as Jacobel’s and those of other physics faculty allow students to be involved in the scientific process at an early stage. “As a result,” Jacobel says, “our graduates go on in larger proportions, and numbers, to prestigious graduate schools and eventually into the world of science.”

St. Olaf’s physics students are a close-knit group. Students generally take the same core classes at the same time, allowing them to forge close bonds as they immerse themselves in the coursework. It’s not unusual to find a group of physics scholars in the department’s computer lab, poring over their homework, crunching data from an experiment or taking a break from their studies.

The physics department graduates an average of 14 students a year — a substantial number compared with other liberal arts colleges. In fact, the American Institute of Physicists consistently names St. Olaf to its list of colleges that produce more than 10 physics majors a year.

“Compared with many other physics departments, we are large enough to offer a diversity of faculty perspectives and expertise,” Nitz explains. “But class sizes are small. We have the appeal of a small program without sacrificing breadth of experience.”

After graduation, about two-thirds of St. Olaf physics students continue their education in graduate school, while one-third join the workforce. All physics graduates leave St. Olaf with a firm foundation in both science and the liberal arts. ■



**“The opportunities for student involvement with faculty in their research are exceptional.”**

## Red Hot Research

Between half and two-thirds of St. Olaf physics students will participate in undergraduate research during their college career. There are research groups in atomic physics, surface physics, positron research and geophysics, and students may spend time on other college and university campuses doing summer research.

Research groups include:

- ▶ **The Molecular Beam Research Group**, which studies the interactions of nuclei in molecules with each other and with the molecule’s electrons using an electric resonance spectrometer.
- ▶ **The Positron Research Group**, which uses positrons and the atom positronium to study basic atomic collisions and biological materials.
- ▶ **The Nanomagnetism Research Group**, which studies the fundamental magnetic properties of small particles for use in spintronics and memory storage.
- ▶ **The Friction and Surfaces Research Group**, which investigates the fundamental properties of surfaces, down to the scale of atoms and molecules, and the ways in which surfaces interact to produce friction, wear and lubrication.

## PHYSICS CLUB

Physics faculty and students meet once a week to learn from outside speakers and one another about the latest and greatest thinking in their field. Recent topics include:

- **Soft Condensed Matter: Where Physics, Chemistry and Biology Meet**
- **An Introduction to Integrated Circuits and Microelectronic Fabrication**
- **Ethics and Physics**
- **Ultrafast Optics: Hitting a Bell with a Hammer**

## Thinking Globally

Field research conducted by St. Olaf physics students Doug Stone, Erin Peterson, Peter Pearson and Robert Engle at Storglaciären in arctic Sweden is changing the way scientists think about glaciers and how they flow. To determine how global climate change is affecting the earth’s polar regions, students use remote sensing imagery and ground-based geophysical experiments to detect troubling changes in the world’s ice sheets and glaciers.

# Polar Bound



**A** lifelong interest in meteorology and climatology brought Knut Christianson '05 to St. Olaf. His participation in the St. Olaf Ice and Climate Research Group led by Physics Professor Robert Jacobel and Environmental Studies Instructor Brian Welch resulted in Christianson being one of two St. Olaf students selected to con-

duct research on an active volcano on the Aleutian chain of islands. These undergraduate research experiences have also piqued his interest in glaciology.

“St. Olaf has given me an excellent education in physics,” says Christianson, who majored in physics, mathematics and Norwegian, “but, more importantly, it has allowed me to interact personally with scholars who are excited about their fields of study and who share their results with us. What I have learned at St. Olaf will be invaluable when I pursue my graduate studies in atmospheric sciences and geophysics.”

Christianson, a Fulbright Scholar, will spend a year on Svalbard, a group of islands located in the Arctic Ocean, about 1,000 kilometers south of the North Pole. There he will participate in a project called EnviTools that uses ground-penetrating radar and satellites to study glaciers. He intends to apply the experience toward his Fulbright project, “Norwegian Polar Research: A Multifaceted Approach to the Cryosphere.”

