

Hands-on Physics

by Ken Kingery

A degree in applied physics gives students practical experience that opens the door to a broad range of science careers.

Nearly every introductory physics class has a student who asks the age-old question, “When am I ever going to use this stuff?” The class probably also harbors a student whose thirst for physics can’t be quenched by an introductory course; whose ambitions include spending his or her career expanding the field’s knowledge through years of intensive research. But what about the student who finds physics fascinating but balks at the idea of working in a laboratory setting? These students — who show promise and potential — are often lost to other fields in the four-year carousel of careers called college. Indiana University, however, has found a way to satisfy their interests while helping them capitalize on their talents.

The IU Physics Department recently introduced a bachelor’s degree program in applied physics that puts its students on a fast track to high-tech industry jobs. The program replaces several higher-level physics theory classes with practical, hands-on experience labs. Some of the related career opportunities stretch to fields that don’t immediately come to mind when thinking about physics.

“We wanted to make students aware of the variety of careers that are broadly spread outside the realm of traditional physics,” says Matt Shepherd, a professor in experimental elementary particle physics and coordinator of the applied physics program. The program was conceived by two of Shepherd’s colleagues — experimental elementary particle physics professors Alex Dzierba and Rick Van Kooten — to provide a track for physics majors to move straight into high-tech jobs after graduation.

Students on the applied-physics track take most of the same classes as those who are

on the traditional track, with a couple of major differences. Up to two applied laboratory classes that feature hands-on instrumentation experience and challenging computer-interfacing assignments replace more traditional, higher-level theory courses such as advanced mechanics or quantum physics. Students are also required to complete two internships — typically in the summers between the sophomore and junior years and junior and senior years — and author a capstone thesis paper.

The first students to take advantage of the new program, which officially kicked off in fall 2005, interned for the Crane Division of the Naval Surface Warfare Center located in Crane, Ind. The internship was especially beneficial for C.W. Colglazier, who wrote his thesis about his internship work on designing naval lighting systems. After graduation, he accepted a job at NSWC Crane.

The capstone theses aren’t confined to students’ initial subject areas or internships. Julie DiNitto, BS’07, for instance, also interned at NSWC Crane focusing on radar repair. But the subject didn’t quite capture her imagination. Afterward, instead of writing her thesis about her work on radar, she chose to focus on the vibration modes of violins. DiNitto worked with Rick Van Kooten — now chair of the Physics Department — to create mathematical models of violin string vibrations and how the bow and strings interact. She’s currently a graduate student in medical physics at East Carolina University.

“The program has a lot of flexibility,” says Shepherd. “We want to match the students up with what interests them.”

This spring the applied physics program will move into a promising new field — applied medical physics. A new, noncalculus-based class will expose both physics and medical students to the broad but often overlooked field, which

includes radiation therapy, imaging techniques, and nuclear medicine. IU offers students many unique opportunities in these fields through the Midwest Proton Radiotherapy Institute at the Indiana University Cyclotron Facility, one of only six such facilities currently operating in the country. The institute uses proton radiation to treat patients with benign and malignant tumors.

Proton therapy is an emerging form of radiation therapy used to treat cancer patients. The difference from more traditional radiation techniques is that protons target areas affected by cancer more precisely than traditional X-ray treatments. The result is less damage to healthy tissue while a maximum amount of damage is inflicted to cancerous tissues. There is also a lesser risk of side effects such as nausea, vomiting, or diarrhea. The procedure is still relatively young, with many new institutions currently in various stages of development.

And with more proton therapy facilities being built across the country, there will be plenty of need for skilled technicians in the world of applied medical physics. In fact, there is already a high demand in the field.



Matt Shepherd

Courtesy Photo



Julie DiNitto

Courtesy Photo

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“It’s an invisible field,” said Susan Klein, a biophysicist at the Cyclotron who will teach the applied medical physics course this spring. “The pipeline of qualified personnel is restricted because few facilities exist that provide the necessary education and training, and even fewer students are aware the field even exists. Most estimates claim there are currently more than 5,000 unfilled positions in applied medical physics.”

Two students in the applied physics program already took Klein’s advice and jumped into the applied medical physics job pool last summer. Jeff Hajewski and Phillip Anuta interned at ProCure Treatment Centers Inc., a Bloomington-based proton therapy training facility that will feed into future and existing proton therapy centers across the country. ProCure, founded by former Cyclotron director John Cameron, has built a template for the design, financing, construction, operation, and maintenance of proton therapy facilities. The ProCure Training and Development Center in Bloomington offers clinical, technical, and administrative training that simulates all aspects of proton therapy treatment.

New facilities are financing a lot of work on logistics such as the organization of treatment rooms and computer software

that models patient flow. These are areas where ProCure hopes to engage interns from IU’s applied physics program — such as Hajewski and Anuta — as employees in the coming summers.

“We would like to have them back and hope to bring in even more interns from the applied physics program,” said Niek Schreuder, senior vice president of medical physics and technology with ProCure Treatment Centers. “These guys were just outstanding. They had energy just bursting out of their ears.”

Hajewski used his computer programming skills to create a new user interface for one of the company’s computer programs. Anuta created 3-Dimensional renderings of the physics robotics, medical instrumentation, and the treatment rooms they must fit into. The internships were a success for both the students and ProCure.

“The internship was extremely beneficial,” says Hajewski, a junior majoring in both physics and mathematics who plans to return to ProCure next summer. “ProCure’s president (Dr. John Cameron) was adamant that we continue to work with

the company through college. It’s really neat to already have job opportunities.”

Anuta also enjoyed his experience at ProCure, but sees the applied physics program as an opportunity to explore the different areas of physics. A three-month internship, he says, really allows students to find out whether a job fits them or not. Next summer, Anuta plans to find an internship

outside of the Bloomington area in renewable resources, and he’s confident Shepherd will help him.

“Matt Shepherd is a really great guy who will discuss your options and interests,” said Anuta, a senior majoring in physics and German. “He’s very good at finding internships that will suit you the best.”

The applied physics program — while still in its infancy — is beginning to grow under Shepherd’s guidance. He has already enlisted six more students for next year and hopes to eventually double the number of undergraduates in the physics department by drawing high school students to IU. He has spoken with companies such as Cook Medical and Boston Scientific, and he is just waiting for the right students to place in internship positions with these reputable companies.

“We began the program by identifying a couple of students already in the physics program who would want to participate,” said Shepherd. “Now we want students to come to IU specifically for the applied physics program.”

“Typically when students in Indiana think about physics, they think about Purdue because they have an engineering program. We want to get the word out about the great opportunities that Indiana University has in the field, and the applied physics program is just one step among many in the right direction.”

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Student Jeff Hajewski interned last summer with ProCure Treatment Centers Inc., a Bloomington-based proton therapy training facility.

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