

## **Fermilab Education Programs, Summer 1989**

*by Christine Grusak*

Fermilab has been investing in the futures of bright, qualified scientists-to-be for nearly 20 years through a variety of educational programs. This past summer has been no exception. Some of these programs include the Summer Internship in Science and Technology Program, administered by the Fermilab Equal Employment Office (EEO), continued to bring promising minority undergraduates in physics, engineering, and computer science to the Lab. The Target: Science and Engineering Program, also administered through the EEO, provided minority high school students with a chance to discover what it's like to work in a scientific environment. The Undergraduate Honors Summer Program, funded by the Fermilab Physics Department and coordinated by Drasko Jovanovic (CDF), brought yet another group of 25 college students from the United States and around the world to Fermilab where they are introduced to the field of particle physics. And the Summer Research Program for Teachers gave 22 teachers hands-on experience with a wide array of Fermilab endeavors in a broad spectrum of the Lab's elements, from safety and computing to theory and accelerator operations.

### **The Summer Internship in Science and Technology Program**

Students from this program spend 11 weeks at Fermilab, working with a supervisor on either an individual project or a small piece of a larger research project. Finley Markley (TS/Engin.), chairman of the program committee, emphasized that whatever the students work on must contribute positively to their education. "We expect the students to be productive and helpful in their program," said Markley, "but we also expect the reverse. That is, the supervisor should also be helpful and productive in the students' efforts to acquire some knowledge about science. We want them to participate in a research project."

In addition to the research project, students attend weekly lectures and prepare a final paper and presentation based on their project. Dianne Engram, of the EEO, sees the lecture series as particularly beneficial. Each lecture addresses a different area of research taking place at the Lab. "While they're here," said Engram, "they're not just exposed to the one area that they work in, but throughout the ten weeks they get a fuller understanding of the scope of the research at a laboratory of this size." Markley added that the final presentation and paper are also very important aspects of the program. "Both the paper and

the oral presentation give students some experience doing the kinds of things they're going to have to do during their professional lives."

Aggressive recruiting ensures that the top students participate in the program each summer. A committee of approximately seven Fermilab staff visit campuses across the country every fall and winter, interviewing students recommended by their departments. Committee members target schools with high minority enrollments throughout the nation and Puerto Rico. But, as Markley points out, if the committee hears of a single interested and qualified student at a particular university, "We will still certainly try to make contact. We'll do whatever is necessary to find good students."

Jim Davenport, Chairman of the Physics Department and Professor of Physics at Virginia State University, coordinates the Summer Internship Program. Davenport has been involved in the program since its beginnings at Fermilab in 1970. In addition to advising students on educational and scientific issues, he serves as a link between students and their supervisors, and recruits Fermilab staff to give the weekly lectures. As a member of the program committee, Davenport also recruits new students in his area of the country.

The Summer Internship Program also serves as a direct conduit for the Universities Research Association Graduate Minority Fellowship. URA Fellowships are awarded to physics students who show potential as scientists and who have participated in the Summer Internship Program.

Feedback on the Summer Internship Program has been consistently positive, both from the professors of participating students and from the students themselves. "Their professors specifically see an improvement in the students' understanding, and an improvement in their attitude," said Markley. "Also, it is almost unanimous that when the student goes back enthused about the exciting scientific summer he or she has had, the next year we are almost overwhelmed with students that want to come and join Fermilab."

### **The Target: Science and Engineering Program**

Students today are faced with complicated career choices and may not have the opportunity to weigh those choices in any detail. Fermilab's Target: Science and Engineering Program has been helping area minority high school students explore careers in science and technology for almost 10 years by showing these students what it's like to work in a scientific environment.

The program began in 1980, when the Department of Energy (DOE) allocated internship funds which enabled minority high school students to spend their summers working in DOE-supported research laboratories. The goal of the program was to provide students with both academic enrichment and practical

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employment experience. Lectures and tours expose students to areas of science and industry they may not have known existed. In a computer lab, students brush up on computer skills before attending college, and in counseling sessions, students learn strategies for applying to colleges and choosing a career.

During the program, students may work in an office or technical area with Fermilab scientific personnel. While not engaged in actual research, the students do experience what it is like to work in a technical field. For many, this is their first job of any kind. "If your first work experience is the positive experience we hope to provide, it can be very motivating," said Dianne Engram. "With good science or math backgrounds, the students learn about some of the jobs to which they can aspire."

Afternoon sessions are devoted to one-on-one work with the students. In addition to the computer lab and counseling sessions, students work on special science projects chosen from a list of abstracts sent with their letters of acceptance. At the end of six weeks they present their projects in a paper and a formal presentation.

"The premise of the program is that these are talented minority students," said Engram, "but because of constraints on funds for public education, they may not have had the opportunity, time, or resources to develop something that their imagination and their talents would enable them to develop." Students learn a great deal about critical thinking during their six-week internship. Accustomed to math and science problems where the object is to arrive at a known answer, students must learn to discover the answers on their own. Students also learn about the reality of scientific research, something few high school science labs can offer.

### **The Undergraduate Honors Summer Program**

The purpose of the Undergraduate Honors Summer Program is to inform and perhaps induce students to take particle physics as a subject in graduate school. The program gives students an introduction to a whole field that they wouldn't otherwise be exposed to. While most students involved in the program are physics majors, a smaller number of computer-science and engineering majors also participate.

Out of 200-300 applications every year, Jovanovic first selects the 100 best-qualified students. "And then it becomes very hard, because about 100 of them are really good," he said. A maximum of two students from the same university may attend the program, and this demographic screening, along with students' experience, abilities, and interests, goes into determining the 25 finalists. Jovanovic then matches each of the 25 students with a participating Fermilab

research associate. "The number 25 is not arbitrary," said Jovanovic. "That is the number of research associates at the Lab. We like to keep one student, two at the most, per associate. It would be nice if we could take more students, but we can't."

Writing computer programs and building or running tests on lab equipment are some of the activities students may perform. Chris Lobello, from Illinois Benedictine College, worked with E-771, building a test station for CAMAC. After performing an internship at Fermilab in the spring, his supervisor asked him to apply for the summer program.

"One very good aspect of the program is the laboratory experience and the exposure it gives you to experimental physics," said Lobello. "The Fermilab people do a good job of making sure students gain a basic understanding of physics. You pick up a lot of knowledge in some very specialized areas. It's hard to go back and sit in a classroom."

In addition to their work, students are encouraged to attend the weekly undergraduate lectures coordinated through the Summer Internships in Science and Technology Program. "It's a good introduction to the field to also go to all the other lectures, even if you may not understand everything," said Jovanovic. Students also meet with Jovanovic each week for short informal lectures and advising.

Jovanovic feels that the presence of summer students at Fermilab creates a university-like environment. "There is a certain amount of youthful enthusiasm that students communicate to the Lab," he said. The summer students also give Fermilab staff a chance to exercise their teaching skills. Jovanovic explained, "Since most of our staff here does not teach, the program may partially fulfill that function. In any process of education you also hone your understanding of an issue as you explain it to someone else."

Jovanovic advises students to develop a familiarity with other domains of physics. Though a supervisor may re-hire a student for the following summer, students may only participate specifically in the Undergraduate Honors Program once. If they wish to do more physics work, Jovanovic suggests they explore other areas of physics. "I strongly encourage them to apply to other labs, such as Bell Labs," said Jovanovic. "They should not necessarily see particle physics as the only field open to them."

However, some students from the program have remained in particle physics and have even returned to Fermilab to do graduate work. Richard Benson, a graduate student at the University of Minnesota, is doing his doctoral work at the Lab. He is enthusiastic about his work on E-706 (direct photon production), and his experience with the Undergraduate Honors Program.

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“The program gave me an opportunity to meet other people doing physics,” said Benson. “I’ve worked at the Oak Ridge and Brookhaven labs. To me, the most interesting work is being done at accelerators.” As a summer student at Fermilab in 1983, Benson had just graduated from Reid College in Oregon. He worked on a neutrino experiment under Karol Lang, who is now at Stanford.

Jovanovic feels that the program creates a sense of good-will toward Fermilab. Benson echoes this sentiment, saying, “The program left me with a very positive feeling about Fermilab and the research being done here.”



*Participants in Fermilab's Summer Research Program for Teachers. Top row, l. to r.: Dane Camp, Ray Dagenais, Paul Madsen, Richard Kick, Robert Pacyga, Joel Klammer, and Michael Hand. Second row, l. to r.: Willam Burt, Nathan Unterman, Michael Salisbury, Neil Michels, Roger Demos, and James Mashek. Third row, l. to r.: Frank Burzynski, George Eblin, Donald Whelpley, Yvonne Richter, and Anthony Marturano. Bottom row, l. to r.: Charles Osborne, Randall Zamin, Harold Mulderink, and Kenneth Leszczynski.*

*The program began in 1983 with seven teachers from local schools. By summer 1989, the program had grown to include 19 teachers from area schools, as well as one teacher each from Pennsylvania, Minnesota, and Nebraska. Travel and housing funds for out-of-state teachers were provided by the Department of Energy's Office of Energy Research in order to make the opportunities at Fermilab available to a larger set of teachers. Each teacher was assigned a Fermilab staff member as a supervisor, and each of the teachers received a Certificate of Recognition and a congratulatory letter from DOE Secretary James D. Watkins. - Arlene Lennox*