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QuarkNet Interns Enjoy a Summer of Science

For high school students entranced with science, what better place to spend the summer than Fermilab, mentored by scientists and working on equipment for state-of-the-art experiments?

Eleven lucky students spent six weeks of the summer doing just that, working five days a week, seven hours a day, and receiving a stipend for their efforts. Best of all, they got a taste of working in a real laboratory environment and formed a vision of what could lie in their futures.

The students came to Fermilab under the sponsorship of the Fermilab/University of Chicago QuarkNet Center, and worked alongside Fermilab scientists Chris Stoughton and Fritz DeJongh. High school teachers Jim Browne and Julia Dawson provided day-to-day supervision as part of the QuarkNet research internship program.

Stoughton, an astronomer and member of the Sloan Digital Sky Survey (SDSS) collaboration, trained six students to classify stars and their spectra using data from SDSS. QuarkNet teacher Jim Browne (Amboy High School) provided day-to-day supervision of the astronomy team.

Another group of students, selected for their prior experience with LabVIEW programming, worked under physicist DeJongh's direction on projects involving robotics.

One robotics team wrote a program to read phototubes and gather cosmic ray data, thus facilitating the replacement of some old hardwired electronics in the Fermilab Test Beam Facility.

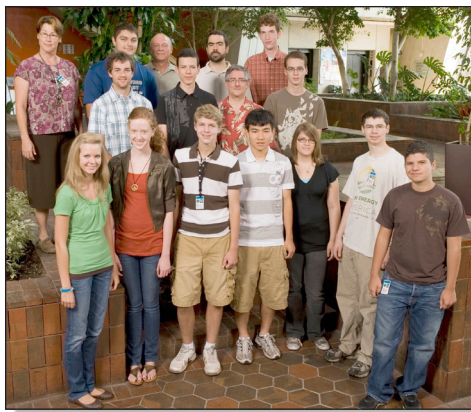
A second team wrote software enabling a 30-year-old robot to interface with modern computers and perform precision assembly tasks on integrated circuit chips. Another student working alone wrote a software program for testing the assembled chips, which are destined for use in the QUIET experiment.

And then there was one highly motivated astronomy student who took on a robotics task in addition to his other work, building a wind meter for the Fermilab Holometer project.

The summer's experience was as positive for the scientists as for the students. Stoughton comments, "It was great working with them. A lot of students applied and we did our best to pick the cream of the crop. I was impressed by how good each of them was. We knew they only had six weeks, so they had

to come up to speed quickly. We spent one week on orientation and learning the ropes and after that they worked on the project."

Stoughton illustrates the caliber of the students with the following story: "I took a couple of days off at a time when they were going to have to learn a complex skill requiring some math. I gave them ideas before I left, told them to research it on the Internet, then let them run with it. When I returned on Monday, no one brought up the topic. So I gently asked how they were doing. They replied, 'Oh, we've got it working.' I asked who had done the work and it turned out that three of them had figured it out independently."



DeJongh was equally complimentary about the robotics team. "I would say everyone is highly impressed with this group of students. With their LabVIEW experi-

ence, they were able to jump in and immediately make genuine contributions to a number of real research projects. They gained experience working in teams and handling the frustrations of a research type environment. Their initiative in coming up with creative solutions was highly evident as well."

As an added challenge to the robotics team, DeJongh set up an experiment for the group to measure the chaotic motion of a double pendulum.

"The students collaborated very effectively on the double pendulum project, obtaining a very rich data set. With just a bit of guidance from me, mainly channeling efforts based on their own initiative, they produced videos illustrating the chaotic motion, and even measured the Lyapunov exponent quantifying the chaos of the system."

DeJongh appreciated the assistance of QuarkNet teacher Julia Dawson. "Having a teacher to help and gain research experience is an ingenious component of this program and a huge asset in pulling it off.

"As you can see, I can't say enough, and definitely hope to do it again."

At the end of the summer the students presented their work to an audience of peers and mentors, QuarkNet teachers, Fermilab scientists and Education Office staff. To view reports on their research, go to: <http://quarknet.fnal.gov/quarknet-summer-research/QNET2010/>.

For more information about QuarkNet
go to: <http://quarknet.fnal.gov/>.

FFSE Helps Summer Institutes Reach New Territory

Each summer, high school teachers from the Chicagoland area spend a week or two attending Fermilab Summer Secondary Science Institutes in biology, chemistry or physics.

They work with master teachers who present content and techniques for engaging students in hands-on laboratory experiences. These institutes are especially useful for new teachers and those who teach science classes in fields outside their specialties.

Gloria Oggero of the St. Clair County Regional Office of Education (ROE) knew her teachers could benefit from the institutes, but St. Clair County is near St. Louis, too far from Fermilab for a weeklong commute. Could the institutes travel to St. Clair County?

Oggero, working with the Fermilab Education Office, selected and scheduled two institutes, one in biology and one in physics. The institutes were part of a larger grant for which Oggero received funding. The St. Clair ROE provided FFSE with the funds so the Education Office could cover the expenses of running the institutes for their region.

Three presenters traveled downstate to present the Biology Institute. Laura Cox (Glenbard South High School), one of the presenters, gives the following report:

"The Biology Institute in St. Clair County, Illinois, was held at Bellville East High School from June 28 to July 2. John Chamberlain, Tom Knutson, [both of Glenbard North High School] and I met with forty-one math and science teachers from all over the county.

"Schools represented included Cahokia, East St. Louis, Bellville, Althoff, Dupo, O'Fallon, and Mascoutah, to name a few. They included public schools, private schools, large schools, small schools, rural schools and urban schools.

"We met with the whole group in a large double room equipped with tables, whiteboards, and an LCD projector; definitely not a science room. Our water came from the bathrooms down the hall, and refrigeration required sneaking our fresh kidneys and chicken feet into the refrigerator in the faculty lounge.

"Fortunately we had planned for a worst-case scenario and we had loaded up John's van with ALL of our equipment from the Summer Biology Institute that we traditionally run.

"In spite of the challenges, it was a successful week. We started at 9 a.m. and, with the exception of a one-hour lunch break, we worked until 4 p.m. every day. Our goal was to bring easy, inexpensive, hands-on activities that promote inquiry science. Participants were grouped and ask to contribute their own best activities for sharing with the whole group.

"We learned the best combination of baking soda and vinegar to blow up a balloon, how to predict the ratio of red to blue poker chips hidden in a paper bag, and that a lot of people are disgusted by chicken feet, even if they can pull the tendons and watch the toes move.

"The rewards for the week included seeing math teachers that were interested in taking some of the ideas presented to use in their math classes, and having many teachers thank us for all the great new ideas.

"I feel that this institute was certainly worth the time, effort, and money that was required to pull it all together and I'd like to thank Fermilab Friends for Science Education for making these workshops possible."

Glennon Nettemeyer, an honors biology teacher in East St. Louis District 189, attended the institute and came away impressed. "All the experiments were very good," he said, "and I've started out the year right away with the one about mixing chemicals. I've also used the movie about the Ebola virus in Africa and how fast it can spread."

Nettemeyer has attended various programs over the past few summers but says that this was the best. In particular, he commented that the workshop offered good methods for incorporating math into a biology class.

The successful Biology Institute and the companion Physics Institute that followed are now the latest examples of what is possible "with a little help from Friends."

FFSE Members: Tour the Magnet Factory on December 11

As a member of FFSE, you are invited to a special tour of Fermilab featuring an inside look at the superconducting magnet research and development facility.

By joining FFSE you have demonstrated your excitement about the science and educational programs at Fermilab. With this tour you can explore an important part of the laboratory and share your enthusiasm by bringing family and a few friends.

Join us **Saturday, December 11, at 10:00 a.m.** for an overview of Fermilab, a tour of parts of the accelerator complex, a visit to exhibits on Fermilab's accelerators and experiments, and a trip to "The Magnet Factory."

Attendance is free but limited, so preregistration is required. Children under 10 years of age cannot be allowed into certain areas.

Watch your mail for more details.

Joint FFSE/ISTA Membership Opportunity a Success

Since 2008 FFSE has offered teachers the option of a joint membership with the Illinois Science Teachers Association (ISTA). FFSE members can join ISTA at the same time that they join or renew their membership in Friends.

ISTA, the Illinois Science Teachers Association, is a state chapter of the National Science Teachers Association. As the state association for K-12 science education, ISTA aims to promote excellence in science teaching and learning throughout Illinois. It sponsors workshops and conferences and provides programs and services to the state's science educators.

Asked how a joint membership with FFSE benefits teachers, ISTA Executive Director Harry Hendrickson observed that, "Teachers love convenience, collaboration, cooperation, communication, control of their membership data, and complexity made simple. The ISTA board and officers like the joint membership concept and we used the model set up between FFSE and ISTA for other joint memberships."

A strong teacher response has proven the value of the concept. According to Hendrickson, "Teachers have utilized the joint ISTA/FFSE membership program about 125 times from early 2008 to now. It appears that about 90% of the teachers sent their joint memberships to ISTA and 10% to FFSE. Most

of these teachers have northeastern Illinois mailing addresses. This is a strong indication of the success of this program for both organizations."

Mary Lou Lipscomb, curriculum and professional development specialist at the Illinois Math and Science Academy and an FFSE/ISTA member, sees value in the combined membership approach. "Each organization offers a different perspective and that could provide for some rich discussion regarding science education and ways to improve what is being done in the field."

FFSE's President, Susan Dahl, is also pleased with the new opportunity. "The purpose of our collaboration with ISTA is to expand our networking, whether it be face-to-face, virtual or social. Fermilab Friends is a unique organization. The collaboration of scientists, educators and students is the heart of our mission. We support the efforts of the Education Office in ways that a national laboratory cannot. FFSE has always been about connecting the 'scientists who do science and the teachers who teach science.'"

For more information about ISTA go to: <http://www.ista-il.org/>.

Mmm! Board Members Host Summertime Snacks

For a second year, FFSE board members hosted snack time during the summer teacher programs. As participants munched treats, board members explained the role of FFSE, what the organization provides, and the various levels of membership.

Board member Pat Franzen found teachers in the Particles and Prairies workshop to be "receptive and appreciative" of the information—and the snacks—that she brought. Pat's experience of FFSE programs inspired her participation as a presenter.

Says Pat, "These little offerings are simply a reminder that FFSE is working to provide and constantly improve science education opportunities at Fermilab. The true evidence is within the excellent programs—the curriculum, materials, leadership, docents, and amazing opportunities available for teachers and students.

"I have personally benefited tremendously from my association with Fermilab and consider it an honor to remain part of the Fermilab education family via FFSE."

While munching fruits and veggies supplied by Michael Knapp, middle school teachers in the Beauty and Charm workshop spoke with him about the need for support of science teachers in the schools.

"Quite a few participants talked to me about FFSE and the state of science education as we took a break for snacks after my presentation," Knapp recalls. "Many are feeling the pressure of performance-based education since it is focused on reading and math. Science and other subjects are losing ground (and time)."

Board member Selitha Raja noted the high school teachers' willingness to travel from other corners of the state to participate in Fermilab programs: "I was amazed to hear that quite a few were traveling a very long distance to go to these workshops. They said that they did not mind driving so far and that they really appreciated the workshops"—evidence of the need for these Friends-supported programs.

It is unknown whether the snacks, the personal touch or Friends' outstanding track record made the biggest impression on participants, but the effort resulted in at least ten new Friends from among workshop participants.

Welcome to these new members!

Your contributions enable FFSE to continue in its support of outstanding educational programs.

Watch for your renewal letter!

Thank you for your ongoing support.
If your circumstances allow, please consider contributing at a higher level.
Can your employer be a matching contributor?

Over 37,000 students and 2,500 teachers participated in Fermilab education programs between the start of October 2009 and the end of September 2010.

Membership Form

Annual Dues: Director's Club..... \$1,000
Patron..... \$500
Sponsor..... \$250
Dual..... \$100
Regular..... \$50
Joint FFSE/ISTA membership..... \$39
Teacher..... \$10

*Please check the appropriate membership category and enclose your check made out to **Fermilab Friends for Science Education**. Include matching funds from your company, if applicable.*

Name _____

(Partner) _____

Address _____

City _____ State _____ Zip _____

Telephone _____

Employer (self) _____

Employer (partner) _____

Matching Funds (yes) (no)

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Visit Fermilab Friends for Science Education at:
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P.O. Box 500, MS 226
Batavia, IL 60510-5011