

PREPARED FOR THE U.S. DEPARTMENT OF ENERGY,
UNDER CONTRACT DE-AC02-76CH03073

PPPL-3518
UC-70

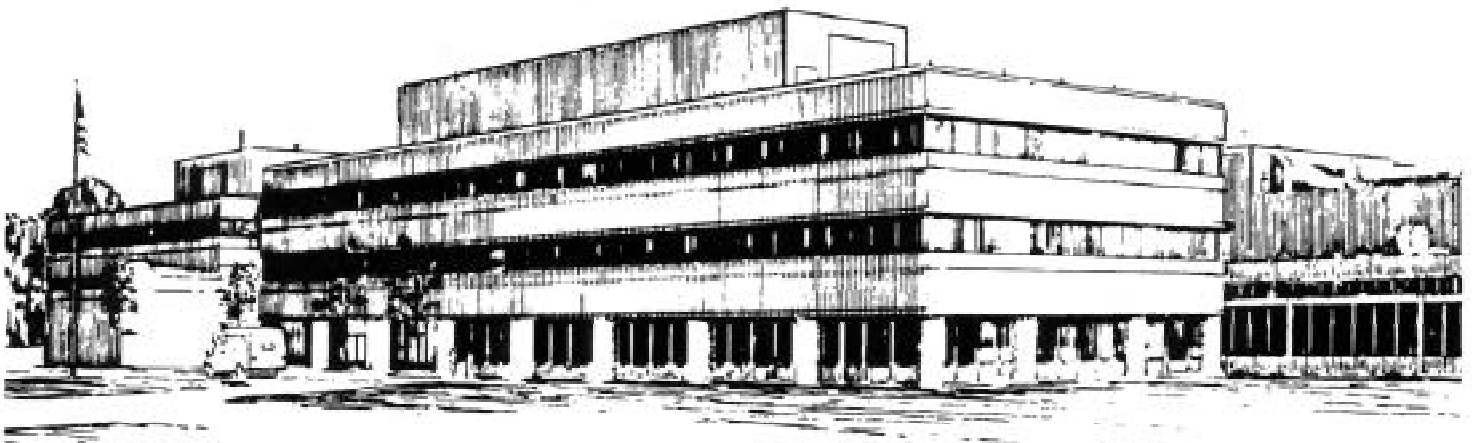
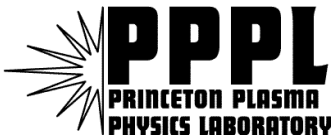
PPPL-3518

An Overview of Science Education and Outreach Activities
at the Princeton Plasma Physics Laboratory

by

J. DeLooper, A. DeMeo, P. Lucas, A. Post-Zwicker, C. Phillips, C. Ritter,
J. Morgan, P. Wieser, A. Percival, E. Starkman, and G. Czechowicz

November 2000



PRINCETON PLASMA PHYSICS LABORATORY
PRINCETON UNIVERSITY, PRINCETON, NEW JERSEY

PPPL Reports Disclaimer

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

Availability

This report is posted on the U.S. Department of Energy's Princeton Plasma Physics Laboratory Publications and Reports web site in Calendar Year 2000. The home page for PPPL Reports and Publications is: http://www.pppl.gov/pub_report/

DOE and DOE Contractors can obtain copies of this report from:

U.S. Department of Energy
Office of Scientific and Technical Information
DOE Technical Information Services (DTIS)
P.O. Box 62
Oak Ridge, TN 37831

Telephone: (865) 576-8401
Fax: (865) 576-5728
Email: reports@adonis.osti.gov

This report is available to the general public from:

National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161

Telephone: 1-800-553-6847 or
(703) 605-6000
Fax: (703) 321-8547
Internet: <http://www.ntis.gov/ordering.htm>

An Overview of Science Education and Outreach Activities at the Princeton Plasma Physics Laboratory*

Presented at the 42nd Annual Meeting of the APS Division of Plasma Physics combined with the 10th International Congress on Plasma Physics, Quebec City, Canada, October 2000.

J. DELOOPER, A. DEMEO, P. LUCAS, A. POST-ZWICKER, C. PHILLIPS, C. RITTER, J. MORGAN, P. WIESER, A. PERCIVAL, E. STARKMAN, G. CZECHOWICZ, Princeton Plasma Physics Laboratory.

Abstract

The U. S. Department of Energy's Princeton Plasma Physics Laboratory (PPPL) has an energetic science education program and outreach effort. This overview describes the components of the programs and evaluates the changes that have occurred in this effort during the last several years. Efforts have been expanded to reach more students, as well as the public in general. The primary goal is to inform the public regarding the fusion and plasma research at PPPL and to excite students so that they can appreciate science and technology. A student's interest in science can be raised by tours, summer research experiences, in-classroom presentations, plasma expos, teacher workshops and web-based materials. The ultimate result of this effort is a better-informed public, as well as an increase in the number of women and minorities who choose science as a vocation. Measuring the results is difficult, but current metrics are reviewed. The science education and outreach programs are supported by a dedicated core group of individuals and supplemented by other members of the PPPL staff and consultants who perform various outreach and educational activities.

Introduction

Since the declassification of controlled fusion research in 1958, public communications efforts have been an important part of Princeton's fusion program. In 1982, in anticipation of the start-up of the Tokamak Fusion Test Reactor, a formal PPPL outreach program was initiated. The current goals of the program are:

- To increase public understanding about PPPL's work, the progress that has been made in the development of fusion energy, and the Laboratory's plans for the future.
- To address community concerns about any environmental and safety aspects of PPPL's operations.
- To establish close communications with state, county, and local government units and community services.
- To make PPPL's facilities available to stimulate the public's interest in science and, in particular, to enhance science education.

A more definitive PPPL Science Education Program was initiated in 1990. The current goals of the program are:

- To provide opportunities for students and teachers to engage in scientific inquiry in ways that enhance their understanding of science concepts and scientific ways of thinking.
- To provide innovative opportunities for educators to work together and with scientists and engineers to enhance science teaching and learning.
- To reach out to all students and teachers, particularly those previously excluded from science education opportunities.
- To advocate for the concepts embodied in the National Science and Math Standards.
- To communicate current scientific knowledge, especially that about fusion energy sciences, to members of the community and to extend this effort more broadly using communications technology.

* Supported by U. S. DOE Contract DE-AC02-76CH03073

Many activities are undertaken by the PPPL Science Education and Outreach groups to achieve their mission and the goals stated above. A listing of these activities is included below and will be described in detail later. Items are listed in alphabetical order and as a result, do not imply importance or amount of effort devoted to the activity. The activities are:

Science Education

- Classroom visits
- Energy Research Undergraduate Laboratory Fellowship (ERULF)
- High school internships
- Internet Plasma Physics Educational Experience (IPPEX)
- National Undergraduate Fellowship Program (NUF)
- Plasma Science and Fusion Energy Institute
- Science Bowl[®]
- Science fairs
- Science-on-Saturday
- Science over Supper
- Teacher workshops
- Trenton Partnership

Outreach

- Coalition for Plasma Science
- Community relations
- Displays and exhibits
- General fusion presentations
- Influential visitors to PPPL
- Media relations
- Open Houses
- Partnerships and collaborations
- Publications (bulletins, brochures, digests, handouts, PPPL News, videos, CDs, etc.)
- Publications (scientific reports)
- Requests for information
- Tours (virtual and in person)
- Web Page

Requirements

The U.S. Department of Energy (DOE) Contract with Princeton University has a number of requirements specified for science education and outreach. Various sections require that the Laboratory undertake activities to disseminate information relating to energy in general and Laboratory programs in particular. For the education components, DOE is interested in encouraging members of under-represented societal groups to enter careers in science and engineering. Specific contract measures require PPPL to be a good neighbor and public partner continually working with stakeholders in an open, frank, and constructive manner. As a result of these programs, PPPL has developed Science Education and Outreach programs to fulfill our contract obligations.

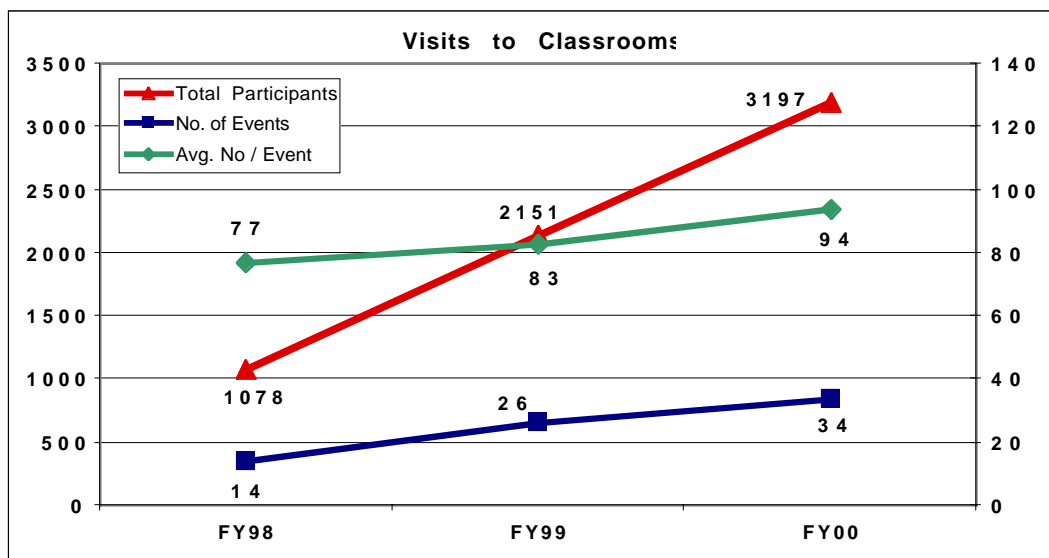
Discussion

The various science education and outreach elements, listed above, will be described. Included is a summary of what we do, as well as measures of performance (metrics) to determine the effectiveness of our efforts. Metrics are not provided for all of the activities identified above, since we do not have data on all of the functions at this time. Even though metrics are maintained for many of the program elements, their actual effectiveness is much harder to measure. How the science education and outreach programs affect an individual's life is best shown anecdotally. We have limited examples where an individual decided to pursue a career in medicine or a science. This is the most direct and personally rewarding result of the science education and outreach effort.

Classroom Visits



Periodically, PPPL scientists and engineers visit local schools to demonstrate science concepts that relate to Laboratory activities. They talk about matter, energy, electricity, magnetism, fusion, and plasma science. In the picture above, PPPL's Vic Garzotta and Ray Camp demonstrate the effects of liquid nitrogen on properties of materials (such as flowers and hot dogs) in the Bear Tavern School in Hopewell, New Jersey. For the last four years, PPPL has provided a series of demonstrations for the entire fourth grade class at this school as part of their "New Jersey Day." In each of these programs, "science toys" are used to actively engage the students.



PPPL tracks the number of visits and the number of students who participate in classroom events. As seen in the graph above, the number of students visited has increased from approximately 1,000 students in FY98 to more than 3,100 students in FY00. Correspondingly, the number of trips to the classroom by PPPL staff has more than doubled during the last three years. One difficulty is that the number of students at each event has increased due to the popularity of the program, reducing the amount of contact between the individual student and the PPPL demonstrator.

Energy Research Undergraduate Laboratory Fellowship (ERULF)



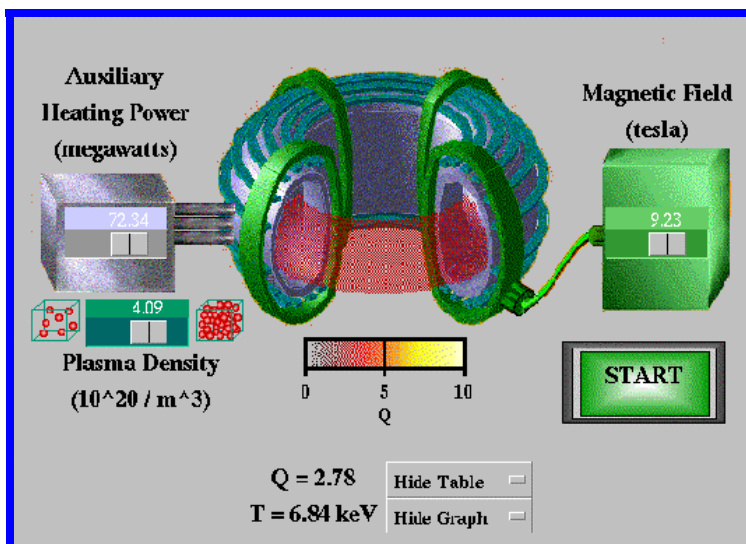
The Energy Research Undergraduate Laboratory Fellowship (ERULF) program places students in paid internships in science and engineering at ten different DOE facilities, including PPPL. Some participants have decided on a career in science and engineering because of their experience. Mentored by scientists and engineers, students work on projects related to the Laboratories' research programs. Above are the seven ERULF students who worked at PPPL during the summer of 2000.

High School Internships

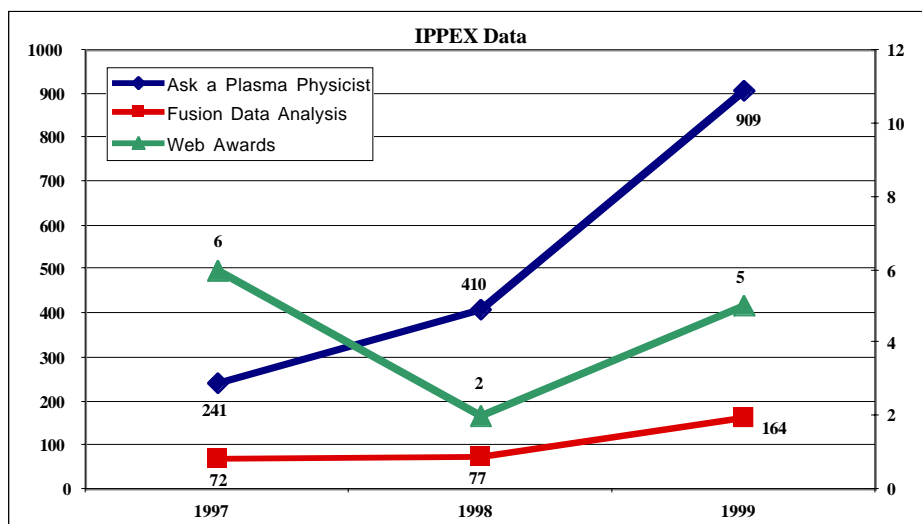


PPPL provides opportunities for high school students to obtain experience in the work force. Students have worked in labs analyzing environmental samples and have worked with engineers on specific projects. PPPL scientists also mentor students who are interested in plasma science. Currently, two students are working with PPPL's Dr. Andrew Post-Zwicker building plasma-related projects, which will be submitted to major science competitions. At left, PPPL's Carol Phillips is showing the PPPL web page to two high-school interns.

Internet Plasma Physics Educational eXperience (IPPEX)



The Internet Plasma Physics Educational eXperience (IPPEX) is a web site developed and maintained by PPPL. It includes interactive pages on matter, electricity, magnetism, energy, and fusion. There is a virtual fusion reactor, the “Virtual Tokamak,” and a virtual magnetic stability module. Visitors to the site can analyze actual data from fusion experiments and pose questions relating to fusion and plasma physics via e-mail, using “Ask a Scientist.” In 1997, IPPEX was featured on WNET Channel 13 in New York. Neil Farley, a physics teacher at the Bronx High School of Science, and his class were shown using the IPPEX web site as an interactive teaching tool. PPPL’s Dr. Andrew Post-Zwicker was interviewed in that video as one of the IPPEX developers.



The IPPEX metric shows that the “Ask a Scientist” effort has grown from approximately 240 questions in 1997 to more than 900 in 1999. It is also interesting to note that the number of individuals who used the detailed IPPEX interactive elements has more than doubled from 72 to 164. Thus, individuals are taking a significant amount of time to study the problems on the web site and develop appropriate responses. During the last three years, the IPPEX web site has received 13 awards.

National Undergraduate Fellowship Program (NUF)



PPPL administers the National Undergraduate Fellowship Program for the Department of Energy's Office of Fusion Energy Sciences. Up to 25 college juniors can participate. The program consists of a one-week intensive plasma science and fusion course, including hands-on experiments in the PPPL graduate lab, followed by nine weeks of work at one of the DOE's fusion facilities. Students are supported by mentors who are required to submit a project proposal, which is evaluated by a community committee. This committee is responsible for matching appropriate students and proposals. Often, these students decide to study plasma physics and as a result, end up in a plasma science graduate education program (see letter to the right). The participants in FY00 are shown in the picture above, while the work locations and student numbers are depicted below.

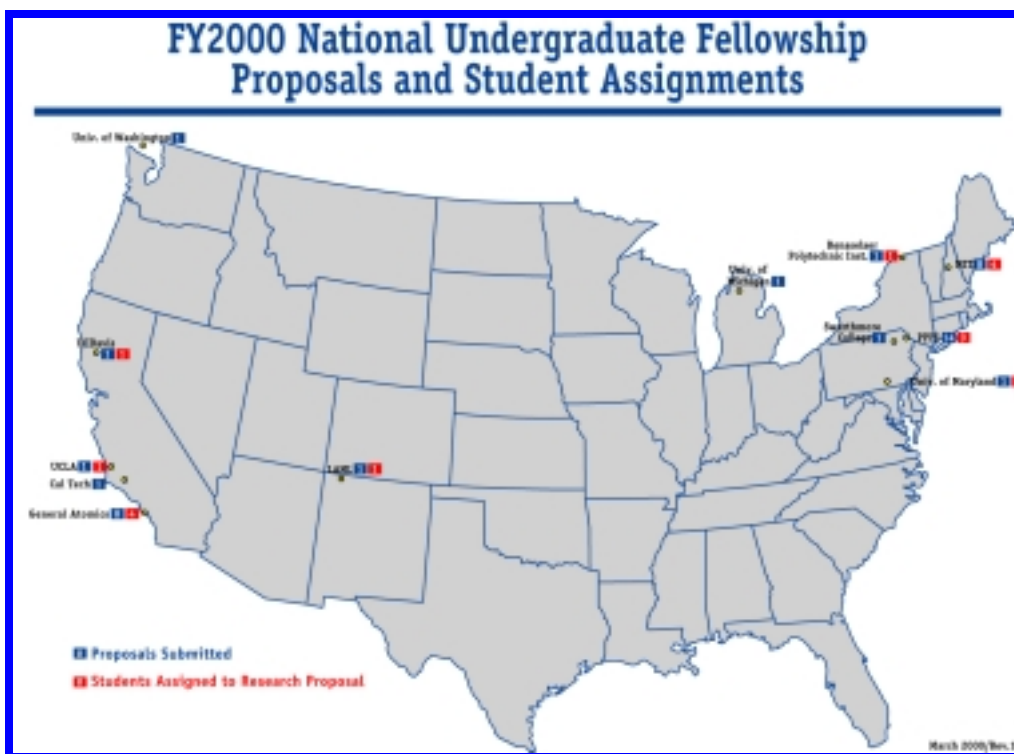
Ms. Pamela Lucas, 8/19/2000

I wanted to personally thank you for all your hard work this summer - it definitely was the experience of a lifetime. I am (thanks to the NUF) really excited about my decision to pursue graduate studies in physics. I am also now very interested in pursuing Plasma physics.

I can't think of how the NUF program could be improved - for it far exceeded my expectations.

Thanks for looking after all of us kids in the NUF program all summer, too!

- Nicole Wasinger



Plasma Science and Fusion Energy Institute (Plasma Camp)

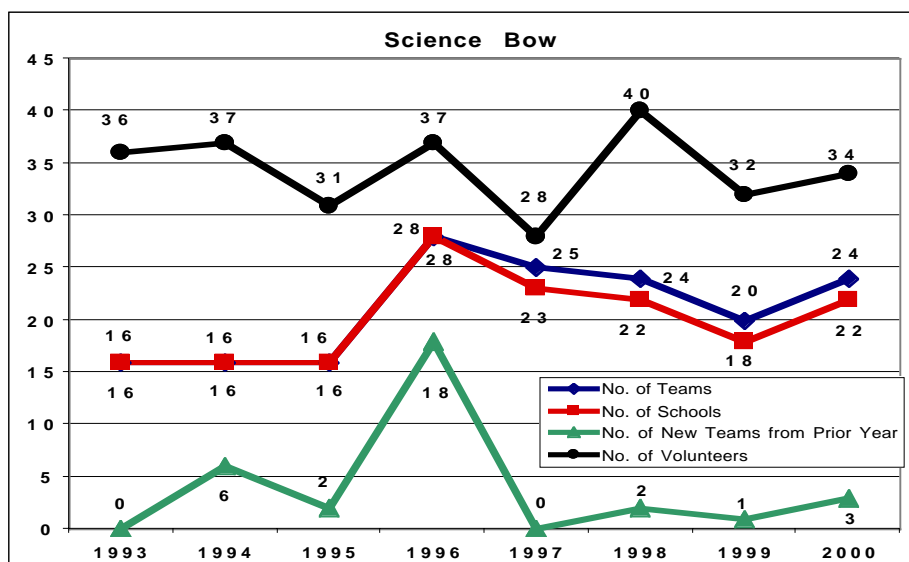
For the past three years, PPPL has held an intensive two-week Plasma Science and Fusion Energy Institute (affectionately known as “plasma camp”) for a select group of high-school physics teachers. The program is run by PPPL’s Dr. Andrew Post-Zwicker and Mr. Nick Guilbert, Chairman of Science Programs at the Peddie School in New Jersey. In addition, some PPPL graduate students and principal investigators assist with the program. On average, 10 to 12 teachers participate each year in the program. Mornings are typically spent in lectures, with afternoons devoted to experiments. The end product is curriculum that exposes their students to the beauty and wonder of plasmas within the context of the traditional classroom setting. A key aspect is how the teacher weaves plasmas into existing classes (rather than creating an entirely new program which could not be supported in a fully scheduled school year).



Teacher applications have been received from all over the United States. A competitive selection process eliminates more than two-thirds of the applicants. For the past two years, three former participants have been invited back to help mentor the new teachers, as well as further their own plasma studies. These returning teachers are able to conduct more complex experiments, including a day on PPPL’s Current Drive Experiment-Upgrade machine, with assistance from the principal investigator and graduate students. In a survey taken at the completion of the course, the teachers indicated this has been one of the most intense and successful workshops in which they have participated. Above, Post-Zwicker, Uma Jayaraman from the Lumberton High School in Philadelphia, and Brian Wargo from the Freedom Area High School in Freedom, Pennsylvania, are studying a plasma in the PPPL Graduate Lab. There have been three plasma camps with a total of 30 teachers from around the country. More than 50% have conducted at least one plasma workshop for their peers at either a local or regional meeting of the American Association of Physics Teachers. Seventy percent report using plasma-related curricula in their classes in multiple years (or plan to do it multiple times if this is their first year). Plasma curricula were created and are available to download from the Plasma Camp web site. Ways to incorporate plasmas into existing curricula are explained using quizzes, demos, and labs. Topics include matter, electricity and magnetism, energy, and nuclear physics. Two of the teachers have built their own direct current glow-discharge sources for students to use to do advanced plasma spectroscopy and breakdown labs.

Science Bowl®

Each year, PPPL sponsors a regional Science Bowl® competition for the U.S. Department of Energy. This all-day event requires high-school teams to compete against one another by answering challenging scientific questions in multiple fields (e.g., astronomy, biology, and physics). The winner goes to Washington, D.C. to compete on a national level. Pictured are the East Brunswick High School team which won the bowl in 2000, Congressman Rush Holt (second from right), and the PPPL Science Bowl Coordinator, James Morgan (third from left). Holt is from PPPL's district and moderated the last two rounds of the regional competition.

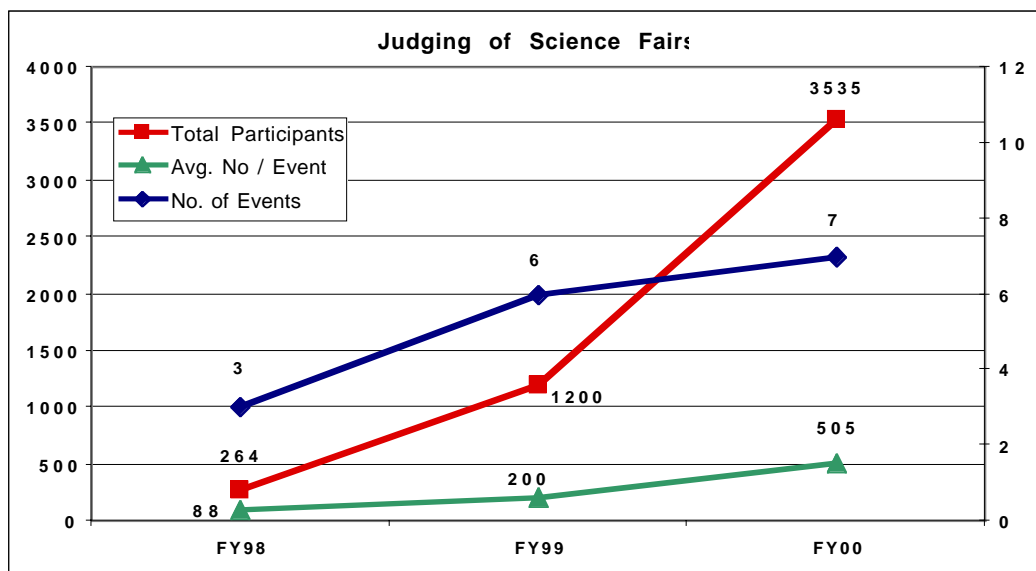


The measures show that the PPPL competition involves about 24 teams each year, with one or two schools supplying more than one team. To be competitive, these students must spend significant time studying and practicing team strategies. The number of volunteers needed to conduct the competition varied between 28 and 40. Interestingly, most of the teams return year after year with one to three new teams joining the competition after 1997. In 1996, there was a significant number of new teams who participated due to an advertising initiative by the PPPL Science Bowl Coordinator.

Science Fairs



PPPL staff serve as judges at local and regional science fairs, which require students to study a particular problem and propose a solution. Ms. Mimelda Poe from West Orange, New Jersey, is shown above with her poster, which describes how a fuel cell works. As a winner at the New Jersey North Regional Science Fair, she was invited to display her project at PPPL. Students exhibiting at PPPL had the opportunity to discuss their projects with PPPL Director Rob Goldston, as well as with members of the PPPL research and engineering staffs.

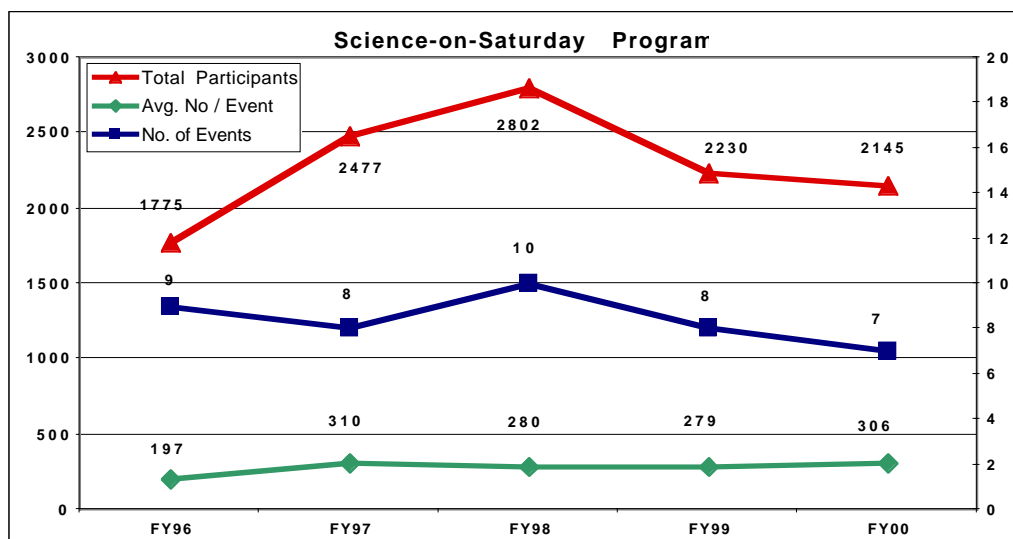


The metric above shows that the number of science fairs judged by PPPL staff has grown from 3 in FY98 to 7 in FY00. The size of the fairs also has increased, with PPPL staff being invited to participate in larger regional science fairs that usually involve more than 500 students. This contact with students allows PPPL staff an opportunity to encourage bright young students in their educational pursuits.

Science-on-Saturday



Science-on-Saturday is a series of free lectures geared toward high-school students, but open to all. Seminars draw more than 300 students, teachers, parents, and community members ranging in age from 8 to 80 each week. The lectures are provided by scientists, engineers, mathematicians, and other professionals involved in the forefront of research in a variety of disciplines. The program runs January through March each year. This year concluded the 15th consecutive Science-on-Saturday program at PPPL. Above is Richard Preston, author of the *Hot Zone* and *The Cobra Event*. He lectured about biological terrorism for this particular Science-on-Saturday talk.

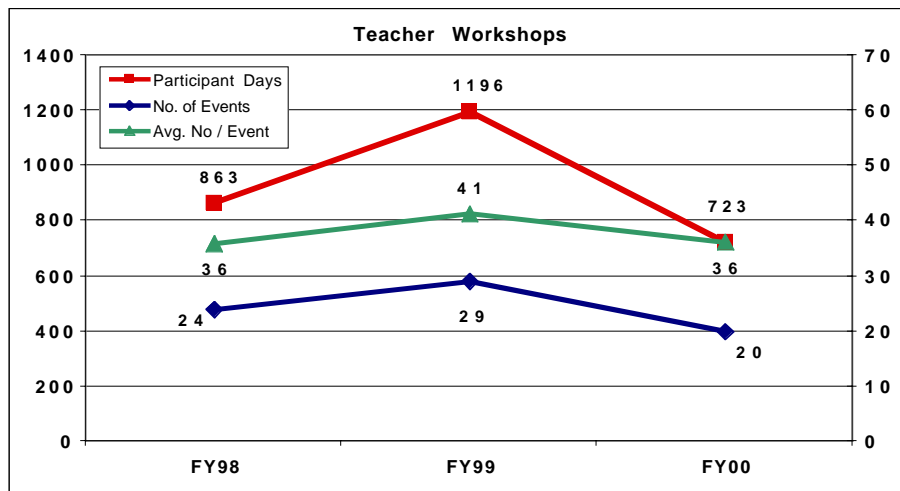


As seen by the metric, the PPPL Science-on-Saturday program has been quite successful. Normally, eight programs per year are established and attendance averages about 300 participants. Interestingly, the audience is divided into two significant populations, high-school students and senior citizens. The local community has a large population of seniors who have been involved in industry or academia and are interested in staying up-to-date on the latest scientific developments. Many of the high-school students receive extra credit from teachers at their school by attending the PPPL Science-on-Saturday program.

Teacher Workshops



Since 1990, PPPL has been conducting summer workshops for local-area teachers. These workshops, which typically span one or two weeks, help teachers find more active, hands-on teaching methodologies. As part of this program, teachers are encouraged to develop interactive science demonstrations for their classrooms. Typically, the programs utilize materials already provided to the school district through partnering with other groups such as the Invention Factory, which refurbishes science kits for teachers. In this particular example, teachers are using a Lego model to see how a flywheel can be used to convert stored energy into linear motion. Part of this exercise is to build the most efficient flywheel as measured by the distance the vehicle travels. A school year teacher workshop is our *Science-over-Supper* activity. A small group of teachers meets after school to have a take-out supper, along with a workshop.



As shown in the chart above, the number of teacher workshops declined in FY00. This was a conscious decision to ensure that the workshops run by the Laboratory were of high quality (quality of the product vs. quantity). Feedback from the teachers who participated was excellent. Even with fewer teacher workshops in FY00, more than 700 days of teacher time were devoted to improving teacher capabilities.

Trenton Partnership



Since 1990, PPPL and the Trenton Public Schools have had a partnership to provide a framework for systemic reform in math, science, and technology education in the district. A key objective of the Partnership is to expand teachers' knowledge of science and math concepts, and to assist them in presenting material in a way that engages students. Through this Partnership, the Department of Energy supports: scientists and engineers serving as science advisors in the schools, classroom visits by scientists and engineers, and laboratory research experiences for students and teachers. In addition to providing technical assistance, PPPL sponsors teacher enhancement workshops and institutes during the summer and throughout the school year. Participants in a summer workshop are shown above.

PPPL has joined forces with the Princeton University Student Volunteers Council to increase the Laboratory's interaction with the Trenton School System. Princeton University students have served as tutors and mentors to Trenton students in urban community programs during the summers. Consequently, Trenton students have shown improvement in their grades and have been named to the Honor Roll during the following school year. Princeton University students have discovered the reward of seeing students successfully grasp previously challenging math and science concepts.

Coalition for Plasma Science and other organizations



Research & Development Council of New Jersey



The Coalition for Plasma Science is a group of institutions, organizations, and companies who have joined forces to increase awareness and understanding of plasma science and its many applications and benefits for society. Providing educational material and teaching aids is an important part of the Coalition's objectives. PPPL is a member of the organization and is contributing to the educational activities.

PPPL also has membership in other organizations in an effort to communicate the fusion message. These include: the New Jersey Technology Council, the Research and Development Council of New Jersey, and the New Jersey Chamber of Commerce.

Community Relations

Building trust with the Laboratory's neighbors is an important responsibility. As part of this effort, two specific meetings are held annually. A breakfast briefing for local elected and appointed officials provides an opportunity for them to visit PPPL, to hear the latest news regarding the Laboratory, and to ask questions. More than 100 individuals (mayors, council members, county executives, police chiefs, etc.) are invited. Attendees spend approximately one hour hearing about PPPL and are provided a tour of the facilities. Local officials continue to be supportive of the Laboratory. PPPL staff also meet with the Plainsboro Environmental Committee (the Laboratory is located in Plainsboro Township, New Jersey). At this meeting, PPPL reviews its annual Environmental Report, a public document placed in the local library. This meeting also serves to keep the Committee up to date on the events at the Laboratory. PPPL assists the Committee in carrying out its responsibilities. For example, PPPL has provided information about radon in the local drinking water.



Assisting neighbors in a time of need is one of the most effective methods of building trust. Above is the PPPL fire engine with two of our security and fire-fighting staff members. Through mutual aid agreements, PPPL personnel assist local volunteer forces by responding to medical, fire, and rescue emergencies. Staffing in the surrounding municipalities for emergencies is extremely low during the daytime. Consequently, PPPL's help during these hours is truly appreciated.

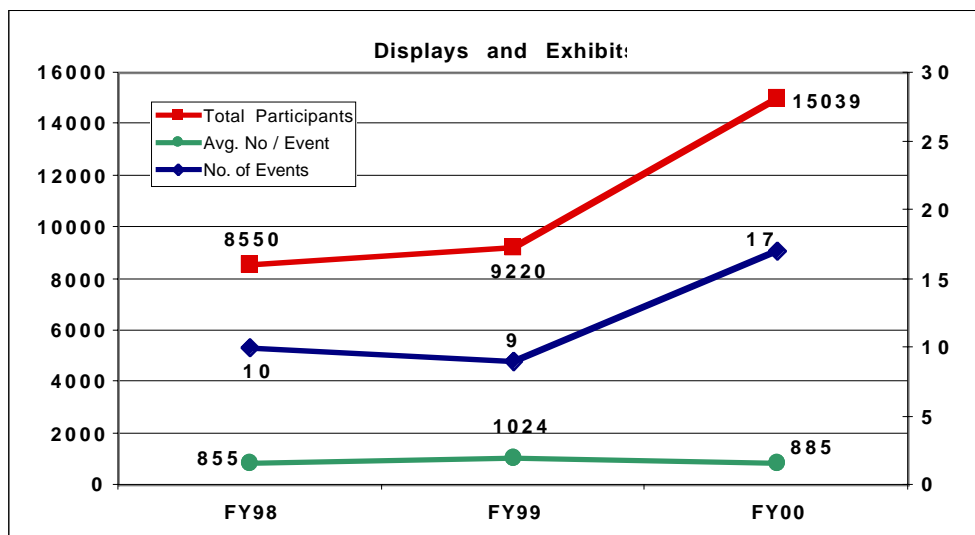
In addition to PPPL's mutual aid agreements, the Laboratory's Health Physics staff supports the New Jersey State Police during radiological emergencies. PPPL's expertise has been especially useful in two incidents involving broken tritium exit signs that resulted in exposure to individuals. PPPL staff assisted in evaluating the incidents, determining exposure to individuals, and verifying that the cleanup was effective.

The good will generated by this type of support is not easily measured, nor can it be predicted. However, we can record the extent of the positive publicity generated by such community service (the local communities always identify PPPL as one of the responding units when a story about the event is published).

Displays and Exhibits



PPPL is invited to exhibit at various events throughout the year. For example, each spring PPPL sets up a booth on the main street in Princeton for the annual Communiiversity Day. Other venues include industrial exhibitions, plasma expos conducted jointly with other fusion community members, and museums. During all of the events, PPPL displays the mission and purpose of the Laboratory, provides brochures and literature written for the public, and demonstrates science “toys” so that children can have hands-on experiences. Our attendance is an opportunity to provoke an interest in science and to allow children and adults to meet and talk directly with scientists. The PPPL demonstrator and the public both have a great time at these exhibits. Above, left, students “play” with plasmas at an Environmental Day at PPPL and, right, Lloyd Ciebiera, a PPPL technician, talks to visitors at the Pennington Day Street Festival.

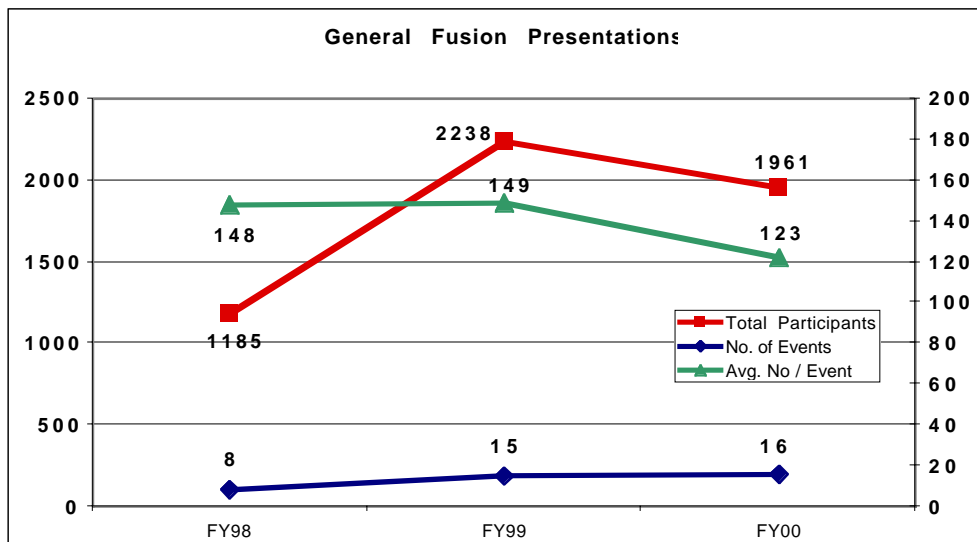


As seen by the metrics, the number of events, as well as the number of people reached from FY98 to FY00 has increased significantly. This is due, in large part, to the PPPL’s responsiveness. Even though a large number of individuals are seen and sometimes significant time is spent with these folks, it is difficult to measure how effectively the fusion and plasma science message was transmitted. Again, the only measure is the positive comments and notes we receive from people who have been by one of our booths or from the sponsors of the event (all feedback and comments received have been positive).

General Fusion Presentations

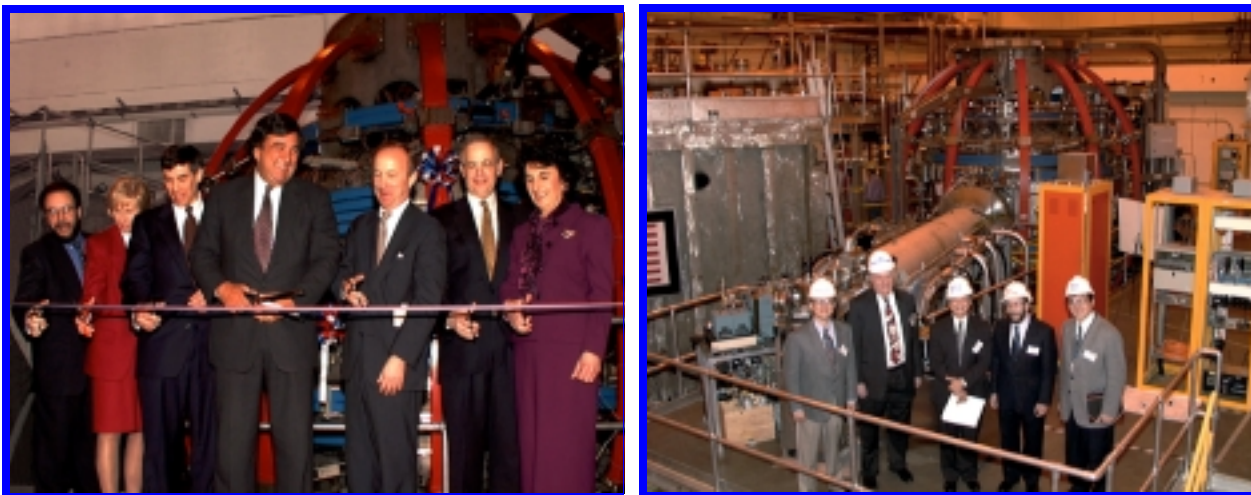


Throughout the year, PPPL responds to requests for speakers to give a presentation on the Laboratory's programs and research activities. Groups include the Rotary, Kiwanis, senior citizen organizations, and professional societies. Presentations are general in nature, and speakers describe fusion energy, its advantages, and how spin-offs of fusion research benefit society today. Included in each talk is a description of how PPPL is funded by the Department of Energy. Above, PPPL Director Rob Goldston gives a talk about fusion to members of the public at the PPPL Open House on June 3, 2000. These talks should not be confused with scientific colloquia given at PPPL for our research staff. However, the scientific colloquia are open to the public also.

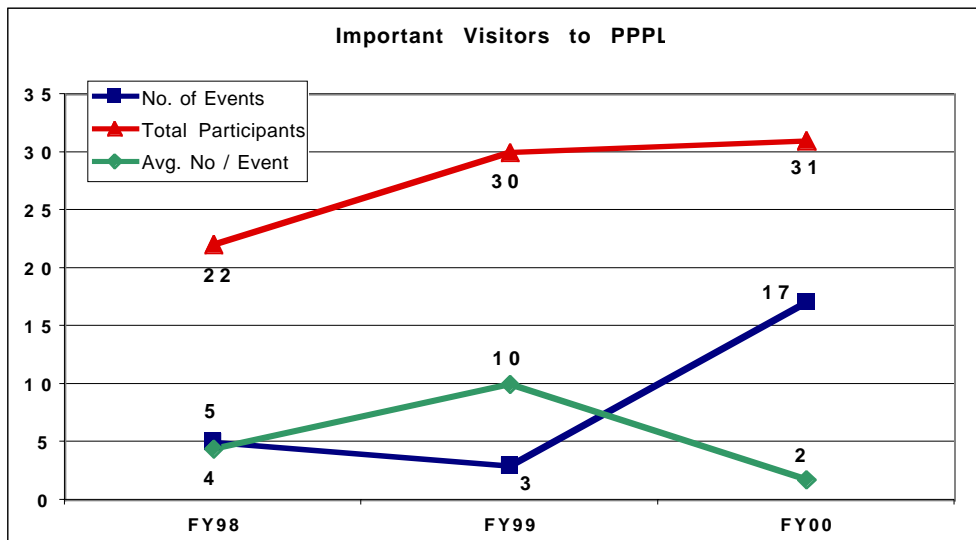


The number of general colloquia given by PPPL staff has doubled since FY98. This is a result of a concerted effort to respond to all requests for speakers, as well as advertising this service. Sometimes, the speaker will use some of the science education “toys” (such as the half-coated fluorescent light) to emphasize plasma, the fourth state of matter. Overall, audience response to the fusion and plasma science message is positive.

Important Visitors to PPPL



Periodically, PPPL hosts visits of government officials and other influential individuals. Pictured on the left at the NSTX first plasma celebration are, from left to right: PPPL Director Rob Goldston, DOE Associate Director for Fusion Energy Sciences Anne Davies, Congressman Rush Holt, DOE Secretary Bill Richardson, Congressman Rodney Frelinghuysen, Princeton University President Harold Shapiro, and Princeton Township Mayor Phyllis Marchand. Plainsboro Mayor Pete Cantu was at the event but not in the picture. In the picture on the right, ORNL’s Martin Peng, Congressman Jim Sensenbrenner, Mr. Harlan Watson, and PPPL’s Rob Goldston and Masa Ono toured NSTX.



The metric for influential visitors to PPPL shows that the number of events of this type has increased while the number of visitors has remained relatively constant in FY99 and FY00. As a result, Laboratory staff are dealing on a more intimate level with each of these visitors. This is a direct result of fewer major events, like the NSTX celebration, where more visitors would be present at one time.

Media Relations

THE NEW YORK TIMES, FRIDAY, JUNE 2, 2000

FAMILY FARE
Laurel Graeber

Pilgrim's Progress

Signs of the new millennium will be as scarce as unicorns at the Cathedral of St. John the Divine tomorrow. In fact, the atmosphere on the church grounds will be more reminiscent of the year 1000 than 2000.

The green will be the site of the cathedral's second annual Family Day Festival, which highlights the arts of the Middle Ages. And while no unicorns will prance, there will be at least one coyote — part of a show that children will help prepare at the green's small puppet theater.

"It's a Native American tale about a coyote in New York," said Nicole Paoli-Ramos, the cathedral's assistant director of public education.


In addition to creating puppets, children can design colorful masks or make brass rubbings from pieces patterned after those in cathedrals like Westminster Abbey.

They can also make paper, string floral wreaths, try weaving, blow bubbles and construct pinwheels to spin in the breeze. Not to mention spinning themselves: the festival will offer Irish and medieval dance.

Finally, families can help create labyrinth walks, the paths of meditation found at many cathedrals. Drawn on canvas or laid out with ropes, a medieval labyrinth is intricate but still easy to follow.

"It doesn't have dead ends, which I think is symbolic because you can't get lost," Ms. Paoli-Ramos said. "It represents a pilgrimage or journey, like the pilgrimage to a cathedral."

Family Day Festival, tomorrow from 11 a.m. to 3 p.m. (rain or shine) at the Pulpit Green of the Cathedral of St. John the Divine, 111th Street and Amsterdam Avenue, Morningside Heights, (212) 832-7347. Free.



Nicole Paoli-Ramos

Brass panel available to create rubbings at Family Day Festival.

ally provide a clean, safe, efficient fuel. Plasma is a gas heated to such an extreme temperature that its atoms fuse, releasing vast amounts of energy. The process is the same means by which the sun converts hydrogen to helium.

"Our sun is really a giant fusion reactor," said Anthony R. DeMeo, a spokesman for the laboratory.

The laboratory has a much smaller one, the Tokamak Fusion Test Reactor, which has produced the hottest temperature ever recorded on earth: 510 million degrees Celsius. Nearby is the latest fusion equipment, the National Spherical Torus Experiment. (Unlike nuclear reactors, fusion reactors pose no danger to visitors.)

"People will be able to go into the test cell where the Torus is," Mr. DeMeo said. "It looks like a big Christmas ornament."

These places of extreme heat have inspired experiments that children will find very cool. They can manipulate magnets (which are also involved in fusion) so they attract one another instead of repel; create giant soap bubbles, which are models for the turbulence that occurs in plasma; and light a fluorescent bulb (it, too, has plasma) without plugging it in.

They can watch a cryogenic show, in which materials like rubber balls and flowers are placed in liquid nitrogen, a medium so cold that it alters their physical structure. "Afterward, you can smash the rubber ball with a hammer," Mr. DeMeo said.

Families can also crawl into a star lab, a kind of portable planetarium, and attend Sports Spectacular shows, which illustrate the physics behind games like baseball and hockey. And, of course, they can enjoy some sources of human energy, like hot dogs, potato chips and ice cream.

Open House, tomorrow from 10 a.m. to 4 p.m. at the Princeton Plasma Physics Laboratory, James Forrestal Campus, off Route 1, Plainsboro, N.J., (609) 243-2750. Free.

Tender Traps

Early tomorrow, workers at the Greenburgh Nature Center in Westchester County will cast their nets, hoping for a good catch. They're not fishermen, although you might say they're fly fishing: their quarry won't have fins, but wings.

The nets, called mist nets, are designed for migratory birds. Virtually invisible, they trap creatures that fly into them, holding them in very soft pockets. The public is invited to watch Dr. Jim Uitter, a scientist from the State University of New York at Purchase, and Eric Rowland, the center's museum manager, record information about the birds and gently place numbered bands on their legs before releasing them.

The data will include "sex, wing length, weight, and where the bird was caught and the time," Mr. Rowland said. Researchers will also use clues like feather patterns and bone structure to estimate the ages of the birds, which are likely to range from catbirds to yellow-rumped warblers.

Although the banding demonstration will be postponed if it rains, visitors can still see about 140 animal species, both native and non-native, in the center's museum. These include snakes, hedgehogs, hawks and at least one bird with a few tricks the migratory species don't possess.

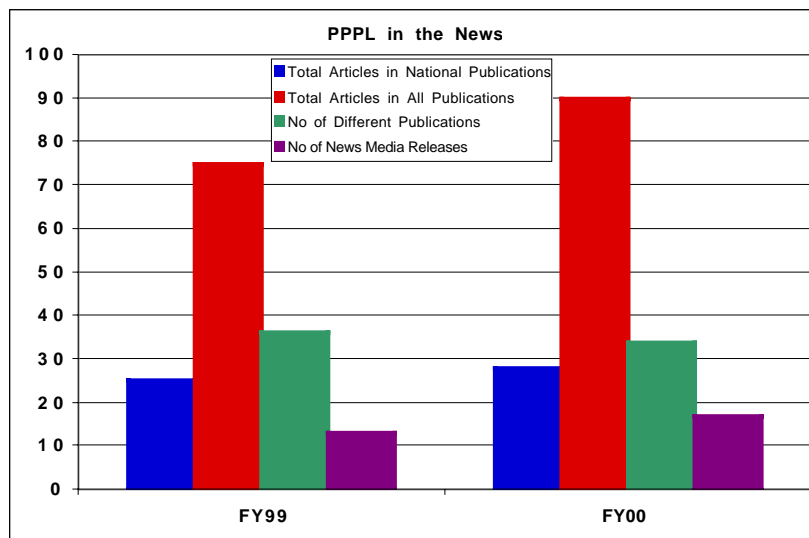
"One of our parrots talks really well," Mr. Rowland said.

Bird banding demonstration, tomorrow at 9:30 a.m. at the Greenburgh Nature Center, 89 Dromore Road, off Central Avenue, Scarsdale, (914) 723-3470. Admission (includes all exhibits): \$4; members, free.

SPARE TIMES

Media relations involve responding to reporters' questions, issuing media advisories, hosting media representatives for interviews of staff or for still and motion picture photography, developing and maintaining web-based materials, developing and updating printed materials, and suggesting stories to the media regarding fusion and plasma science.

An example of media relations is the article on Fusion and Fun that appeared in the *New York Times* Weekend Edition. This was based on a phone call to the *Times* advising them of the upcoming PPPL Open House. The article described activities planned for the event. Measuring the impact of this article was difficult. However, we know that at least one family from Connecticut came to the PPPL Open House after reading the *New York Times* article.



The metric above measures the following factors: the number of media releases issued by PPPL; the total number of articles in which PPPL was specifically mentioned; the number of articles published in a national medium (web or print); and the number of different publications in which stories were published. The trend for each of these items is positive, yet there is no way to measure the direct impact that such publicity has on plasma science and fusion energy research.

Open Houses

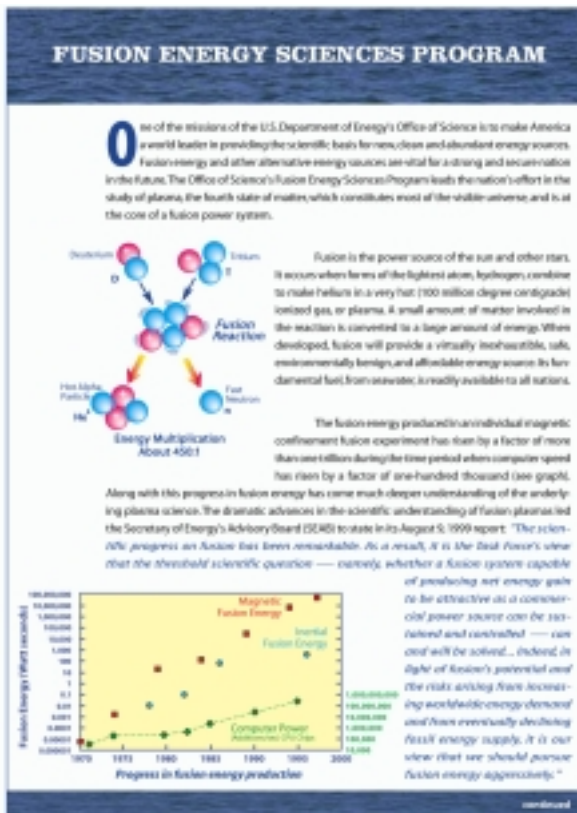
Once every two or three years, PPPL conducts a major Laboratory Open House. This year approximately 2,400 individuals attended such an event on June 3. The pictures below show PPPL employees Ray Camp performing a cryogenics demonstration and Maryanne Tyrell trying out one of the PPPL science toys.

Areas of the Laboratory open to the public this year included: the National Spherical Torus Experiment (NSTX); the NSTX control room; the Tokamak Fusion Test Reactor; the Magnetic Reconnection Experiment; the Current Drive Experiment - Upgrade (operating to show a plasma); the High-Resolution Wall; the Warehouse, which had more than 20 hands-on science toys; fire extinguisher training; the Fire Safety House by St. Barnabas Hospital; and the "Fire and Wires" demonstration by the local power company, Public Service Electric & Gas.

A survey taken of the participants to determine how much they enjoyed the event and how well we communicated our message was very positive. The Laboratory also received unsolicited letters of appreciation, such as that shown on the right.



Partnerships and Collaborations



In addition to a local message regarding the Laboratory, PPPL is actively engaged with the national fusion community to make available appropriate tools to be used in communicating the overall plasma science and fusion energy message. Two examples are shown on this page. One is a two-page document that describes the DOE Fusion Energy Sciences Program; the other identifies all of the organizations involved in the fusion program within the United States (see the map below).

By working with other members of the community, a unified, consistent message can be communicated to the public for the fusion and plasma science research program.



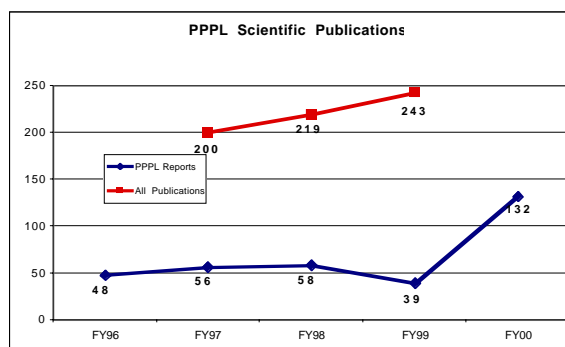
Publications (bulletins, brochures, digests, handouts, PPPL News, videos, CDs etc.)



Communicating the PPPL mission to a wide variety of audiences requires a number of tools. These include written, web-based, and electronic materials. Above are many of the publications that are available for this communication process. Some, like the *Hotline*, are designed to be internal communications for staff. Most of the other documents are intended for the public. These include: *PPPL Digests*, which describe a project or activity; Information Bulletins, which provide an overview of the main projects at PPPL; brochures, such as *The Hottest Place on Earth*, which gives a general overview of PPPL; compact discs, one of which provides a 12-minute PPPL overview video and another about high-performance scientific computing at PPPL; and other individual flyers, such as the map showing the locations of all of the fusion projects in the United States.

Publications (scientific reports)

Technical publications and presentations are the primary products resulting from PPPL's research efforts. R&D results are documented in journal articles and the PPPL Report series. PPPL Reports are posted on the web, making them available to the entire fusion community, as well as to the public. In addition, all PPPL Reports are sent to the U.S. Department of Energy's Office of Scientific and Technical Information, where they become part of America's scientific legacy.



In the measure above, PPPL scientists and engineers publish more than 200 scientific papers annually. Many of these publications are co-authored by researchers from several institutions, reflecting the national and international collaboration activity within the fusion community. Most scientific papers, where the first author is a PPPL staff member, are issued as preprints (PPPL Reports). PPPL is working to get all publications by staff into the PPPL report system.

Requests for Information

Wednesday, October 4, 2000 Information Request Form Page 1

Security Notice

Princeton Plasma Physics Laboratory
Creating innovations to make Fusion Power a Practical Reality

If you would like to receive information about fusion research at the Princeton Plasma Physics Laboratory, ask a question, or send a comment, please complete and submit the form below **(be sure to include your complete postal mailing address)**:

Name:


Occupation:

Mailing Address:

E-Mail:

Would you like to receive an information package about PPPL and fusion research in general? Yes No

Do you have any questions or comments?



[About PPPL](#) | [How to Reach Us](#) | [News at PPPL](#) | [Fusion Basics](#) | [Research Projects](#)
[Technology Transfer](#) | [Education Programs](#) | [Publications](#) | [Meetings and Colloquia](#) | [Home](#)

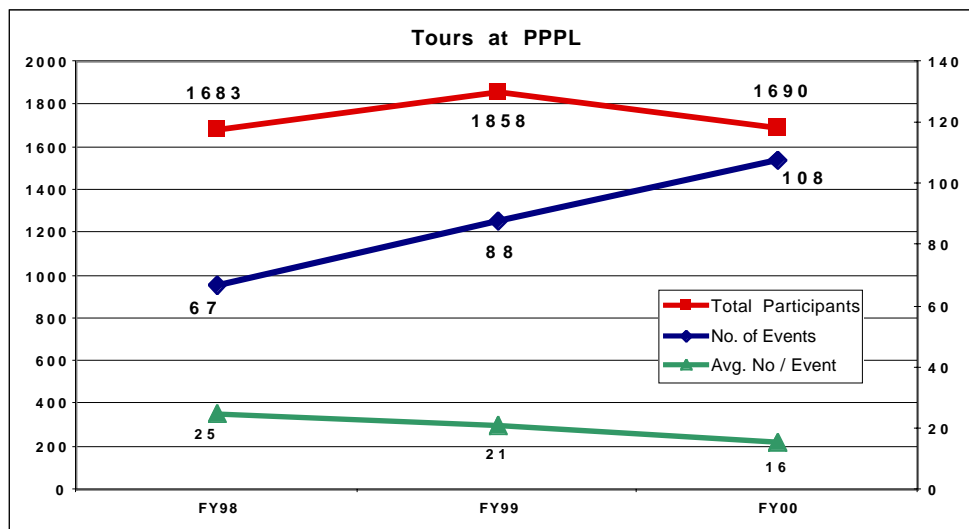
Updated: 17 March 1999
Send questions or comments to: [Carl A. Philos_at_caphill@pppl.gov](mailto:Carl_A_Philos_at_caphill@pppl.gov)

Each year, PPPL receives more than 400 requests for information. Inquiries come to the Laboratory via the web page (see form above) or through letters and phone calls. Some of the requests are from journalists and textbook publishers seeking interviews, still and video photography, and background information. Most come from high-school and college students writing papers or doing science projects. The information requested varies in scope and complexity. Each request is documented and assigned to an individual for response. Our goal is to respond to each request in a timely manner, typically within one or two days.

Tours (virtual and in person)



PPPL arranges tours on a regular basis for groups of up to 300. Above is a tour group at the National Spherical Torus Experiment (NSTX) facility. Areas visited depend on research device operating schedules. In addition to NSTX, groups often visit the smaller machines, including the Magnetic Reconnection Experiment and Current Drive Experiment-Upgrade or even infrastructure support items like motor generator facilities. Many tours are conducted at night and on weekends. Tours are conducted by approximately 30 trained volunteer Laboratory staff and collaborators working at PPPL. A virtual tour of the Laboratory can be taken by visiting the PPPL web site (<http://www.pppl.gov>). There, individuals can visit the Laboratory by viewing some 15 photographs and descriptions. This tour is always available, 24 hours a day, 365 days a year.



Between FY98 and FY00, the number of PPPL tours increased by approximately 60 percent. The number of individuals going on tours remained relatively constant at about 1700 people per year. Consequently, the average size of tour groups has decreased, allowing the guides more opportunity to interact with individual visitors.

Web Page


The PPPL web page is a gateway to the Laboratory. From the PPPL site individuals can jump to the DOE Home page, and from there visit other fusion and science programs. PPPL's web site allows visitors to gather information quickly. For example, the "Education" button takes visitors to information on PPPL's science education programs mentioned previously (such as IPPEX and NUF). A new feature allows journalists and others to locate and download photographs and artwork with sufficient resolution for publication. Thus, these materials are readily available 24 hours a day. The PPPL home page announcing the change in the Science Education leadership is shown below.

[Security Notice](#)


Princeton Plasma Physics Laboratory

Creating Innovations to make Fusion Power a Practical Reality

- [How to Reach Us](#)
- [About PPPL](#)
- [News at PPPL](#)
- [Fusion Basics](#)
- [Research Projects](#)
- [Technology Transfer](#)
- [Education Programs](#)
- [Publications](#)
- [Meetings & Colloquia](#)



[Pamela Lucas, Head
PPPL Science Education
Program](#)



[Andrew Post-Zwicker
Lead Scientist
PPPL Science Education
Programs](#)

[Open House Photos](#)

[Virtual Tour of PPPL](#)


[August Issue of the
PPPL HOTLINE **NEW!**](#)

[August Issue of the
NSTX Program Highlights](#)

[Congress and The Fusion Energy Sciences Program:
A Historical Perspective](#)

PPPL is funded by the [U.S. Department of Energy](#) and managed by [Princeton University](#).

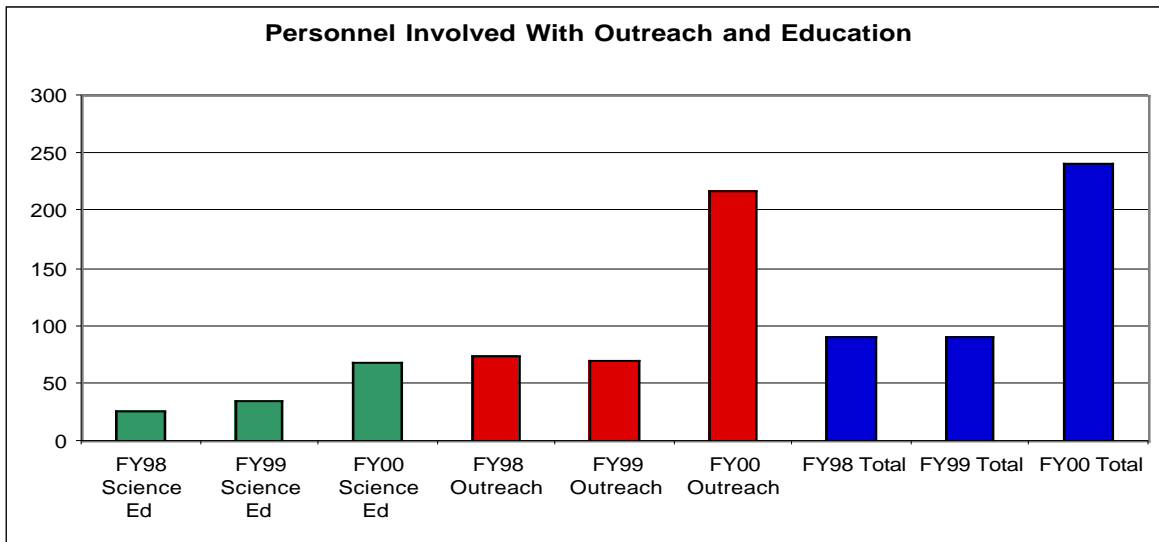
[Request for Information](#) || [Doing Business with PPPL](#) || [Web Site Map](#) || [Download PPPL Logo](#) || [PPPL Library](#)
[Employee Locator](#) || [Web Site Search](#) || [USDOE and Other Fusion Links](#) || [Copyright and Disclaimers](#)



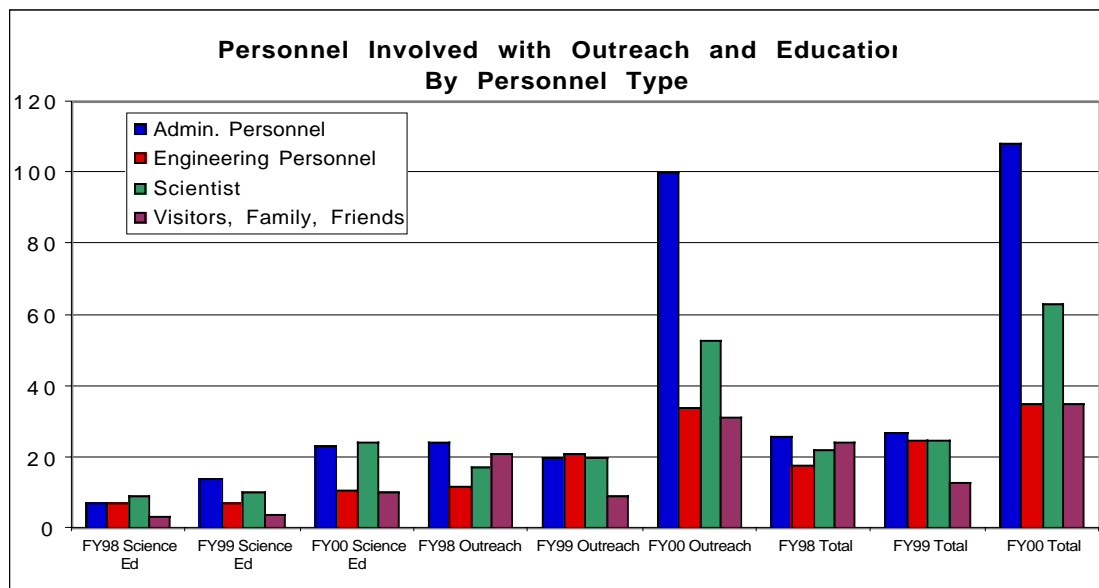
Updated: 30 August 2000

Send questions or comments to [Carol A. Phillips](mailto:caphill@pppl.gov) at caphill@pppl.gov

Personnel Involved with Outreach and Education



Less than 10 full-time dedicated staff are provided for the Science Education and Outreach Program activities. The achievements summarized in this paper would not have been possible without generous contributions of time by the research, engineering, and administrative staffs of the Laboratory. In addition, contributions by our collaborators, family, and friends have also supported the PPPL programs. As the data above indicates, the number of individuals contributing to the PPPL Science Education and Outreach activities has increased from less than 100 in FY98 to almost 250 in FY00. (Note that some individuals contributed to the outreach and science education efforts. Therefore, the totals will be less than the individual activity levels.) Below, the number of volunteers is sorted by employee classification. It is important to remember that many outreach and science education activities occur in the evenings and on weekends. Thus, PPPL employees have given generously of their own time to assist the Laboratory in these efforts.



Conclusions

PPPL has diverse and exciting science education and outreach activities, meeting the requirements of Princeton University's contract with the Department of Energy. PPPL staff members, our collaborators, and family members actively support the Science Education and Outreach Programs. Although metrics have been defined for most program elements, effectiveness is difficult to measure. Only occasionally do we get feedback from a student or a member of the public that provides a direct link to our Science Education and Outreach Programs. This truly indicates the success of our science education and outreach efforts when an individual makes a life changing decision to go into physics or become a medical doctor. PPPL will continue its science education and outreach programs, seeking new ways to communicate our message and to instill in young people an interest and an excitement for fusion energy, plasmas, and science generally.

The Princeton Plasma Physics Laboratory is operated
by Princeton University under contract
with the U.S. Department of Energy.

Information Services
Princeton Plasma Physics Laboratory
P.O. Box 451
Princeton, NJ 08543

Phone: 609-243-2750
Fax: 609-243-2751
e-mail: pppl_info@pppl.gov
Internet Address: <http://www.pppl.gov>