PPPL
PRINCETON PLASMA PHYSICS LABORATORY
HOTLINE

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High Field Magnet Funded

The National Science Foundation (NSF) has awarded a grant to Princeton University for the construction of a High Field Magnet at PPPL. The grant will be awarded over a three-year period.

Says Lab Engineer Peter Bonanos, "The collaboration is a natural outgrowth of the need for high magnetic fields in research by members of the University Departments of Physics and Electrical Engineering combined with the capability of PPPL to produce these fields."

The proposal requesting NSF support was prepared by a collaborating group that includes Professors Paul M. Chaikin and Nai-Phuan Ong of the University Physics Department, Professor Daniel C. Tsui of the University Electrical Engineering Department, and Bonanos of PPPL. In addition to NSF, the project was approved by the University, PPPL, and the Department of Energy.

Bonanos adds, "This project provides a cost-effective approach to high-field magnet research. The power supplies at C-Site were designed to power magnets and are a valuable resource. In addition, we have experience in magnet design, field computation, and construction. During the proposal process, scientists and engineers throughout PPPL have been both supportive and helpful."

PPPL Physicist Ned Sauthoff, Chair of the Subcommittee on Nonfusion Projects, says, "We are very pleased to be participating in this project. It's an excellent example of

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Princeton Undergrads Tutor Trenton Kids in Math and Science

New Science Education Program Provides Summer Internships

Ten Princeton undergrads had a busy, challenging summer working with 250 Trenton children on math and science. The ten were interns in Science Education's innovative Trenton Summer Program which paired the interns with five Trenton community programs serving children.

The internships are a new education initiative funded by the Department of Energy as part of the PPPL/Trenton Partnership. Each intern received $2000 for ten weeks' work.

"This is really an extraordinary program—the first of its kind undertaken by a national laboratory to support undergraduates in offering needed educational services in an inner city environment," said Diane Carroll, who heads the Lab's Science Education Program.

Adds Carroll, "If you consider that children spend only about ten percent of their time in the classroom, the need for education

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The contrast between the wall of graffitti and the lush garden the children work in highlights the importance of the work of ISLES and of intern Ravitte Gall. Photo: D. Applewhite

Princeton Undergrads Tutor Kids

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in other settings stands out vividly. This need is greatly magnified in the inner city where opportunities are so limited. This program is one approach to addressing that need in Trenton—and tapping the creative resources of Princeton students to do so."

Sharon Sherman and Tim Bennett of PPPL's Science Education Program coordinated the Laboratory's participation, while the Princeton University Student Volunteers Council, headed by Chris Drake, recruited and matched students with the five Trenton programs. According to Drake, "All the interns had meaningful experiences, and at least half expect to continue with their work in some capacity this fall."

Said intern Andy Newens of his work this summer, "It has been an incredible learning experience, as we all expected. I've learned about myself, the behavior of children, interrelationships among people, the culture of the street and of black and Hispanic kids. This is different from my own experience when I was their age. I've also learned how to work with others. I've definitely learning more than I've taught. And of course, I'm having lots of fun!"

Creative Science, Math

While many of the interns felt they learned even more than they taught, they threw themselves into providing concrete experiences in math and science for the kids with enthusiasm and creativity.

According to intern Karen Smilowitz, "The children really loved some of the science experiments, such as the styrofoam solar systems we made. Hands-on activities like tracing their own bodies onto paper and then researching and labeling their organs were especially interesting to them."

Kids loved planting seedlings and charting their growth on graphs. Another popular activity was a chemistry pH experiment, in which young experimenters used red cabbage juice as a chemical indicator to identify acids and bases.

Intern Richard Feit, who taught computer skills, derived great satisfaction from the positive evaluations his students gave of how much they enjoyed the math and logic games he wrote for them. He says, "I paired the computers so the kids could type messages to each other. They loved it when the computers 'talked' to each other. They also loved painting with the mouse."

The interns often came up with math games and problems that involved practical situations, which helped the kids see how math could be useful to them. Said an eighth grade student, Crystal, who needed math help, "I couldn't solve word problems or equations, but the tutors knew how to get my attention. They showed me how to learn another way."

Challenges

Interns felt constantly challenged by the demands of the tasks they had undertaken. One recurring theme was the need to establish authority and keep the children's attention. Said Kari Wilkinson, "The greatest aspect of the internship was the girls. They constantly surprised me, both with their achievements and their mischief. I spent half my time praising them and amazed at the new things they came up with, and the other half yelling, 'talking' with them, and trying to figure out good disciplinary measures."

Intern Kari Wilkinson (right) was mentor to four girls in the L.I.F.T. program. They are, left to right, Nancy Simmons, Amelia Holmes, Aisha Johnson, and Aquise Turner. Photo: D. Applewhite

Another challenge was discovering the appropriate level at which to present material. For example, Stuart Licht planned a lesson on atoms, only to discover that one student didn't know what an atom is. Based on his experience, Licht said, "I would suggest that future interns err on the side of making the lessons as simple and basic as possible at first. A challenging lesson might be fruitfully split into several parts, beginning with background and moving to more complex material." Licht and others noted that it's important to enjoy small victories rather than to expect to make a major impact.

A third challenge for the interns was the adjustment to being in the city after having grown up in the suburbs. Said Smilowitz, "This summer has changed my attitude towards everything. It's hard to figure out who's to blame for the lack of opportunity these kids face, but it's definitely made me want to go into the education system."

Ravitte Gall also found that her experience has made her rethink her career plans in the direction of teaching, with hopes of reducing the lack of opportunity. She observed that some of the children she took to Princeton parks to learn about earthworms and about what makes plants green had never been in the woods before. Said Gall, "The potential of the children is just not being developed."

Despite the challenges, however, interns were very positive about their experiences. Many said they would recommend the program to a friend, and some plan to be interns again next summer if funding is found to continue it.

Intern/Program Matches

The Princeton Student Volunteer Council located suitable programs for the interns, according to Administrator Drake. "The Council had previously worked with some of the organizations, while others were new to us. The interns went to the sites for interviews and chose which program interested them the most."

More students applied for the Trenton Summer Program than the spots available. Said Drake, "We tried to choose students who were math or science majors and who were serious about serving in the community." Drake noted, "I would expect at least twice as many applicants next summer because this year's interns have been so enthusiastic and the program has been so successful."

Four Princeton student interns, Rich Feit, Lisa Khouy, Anthony Recine, and Abigail Silver, worked with the **Young Scholars' Institute (YSI)** as teacher aides in the Future Science Program and the Language and Math Development Program.

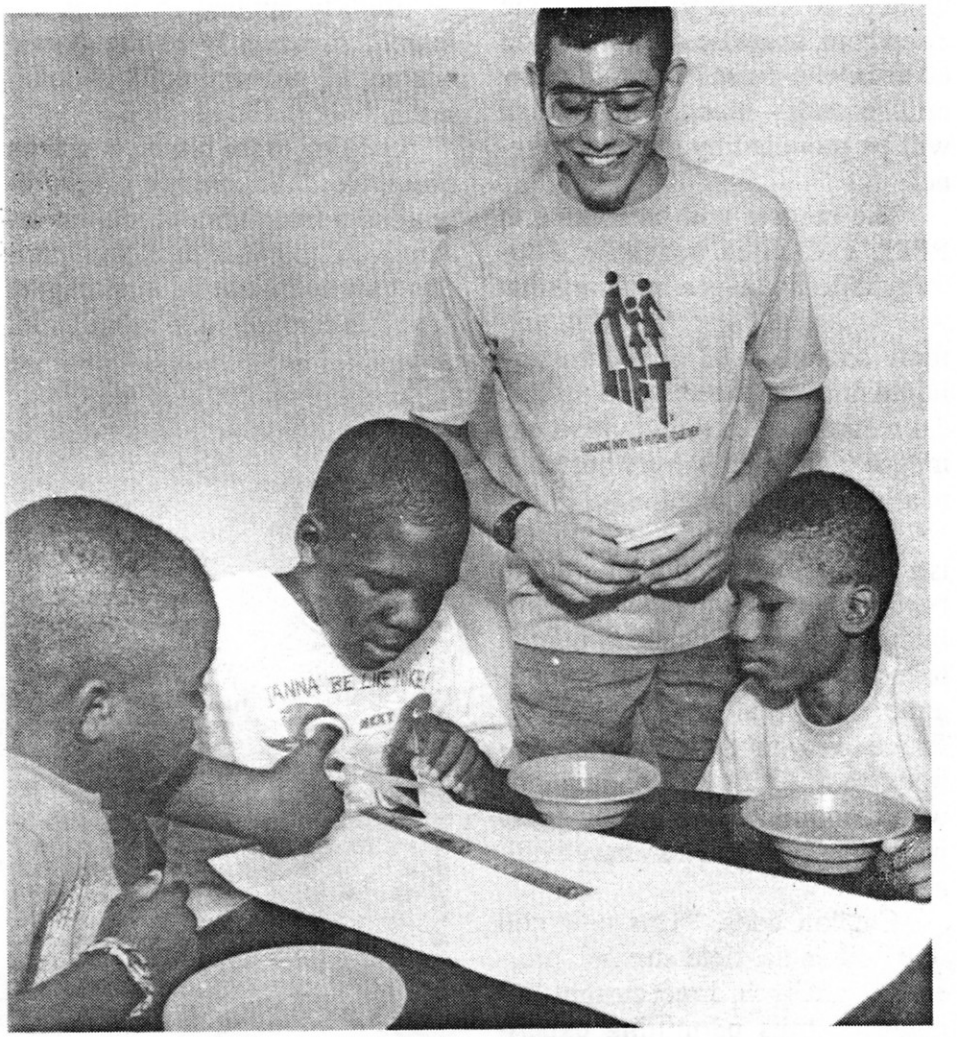
Stuart Licht and Kari Wilkinson were interns at **Looking Into the Future Together (L.I.F.T.)**, which focuses on adolescent parent support and teen pregnancy prevention. The two were mentors for four teens each, providing both academic and recreational activities.

Students Ted Ernst and Karen Smilowitz served as interns at the **Hollowbrook Center**, where they tutored children in math, science, language, and basic study skills.

ISLES, a program focused partly on growing community vegetable gardens in Trenton, employed intern Ravitte Gall, who worked in environmental education with their children's program and arranged field trips for the kids.

Finally, **S.M.I.L.E.—Science and Math Interesting, Learned Easily**—employed student intern Andy Newens, who tutored students in fourth through ninth grades in math, science, and other activities.

Said Sharon Sherman, "Perhaps the greatest strength of the program was the enthusiasm and commitment exhibited by the Princeton student volunteers. Their intelligence and creativity were combined to produce outstanding experiences for the students they touched."



Intern Stuart Licht (standing), using his apartment kitchen as a lab, works with (left to right) Roosevelt Lammons, Kelsey Howard, and Mezel Tyler on a science experiment. Photo: D. Applewhite

High Field Magnet

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collaboration and partnership among DOE, NSF and the University, the Laboratory, and other resources."

The Magnet

The magnet facility is intended for general purposes related to condensed matter physics research, but other uses may be found. The magnet is a small bore (4 centimeter) pulsed cylindrical solenoid* providing central fields of the order of 60 tesla* for one-half second—considered a quasi-steady-state.

At present, lower continuous fields of 30 tesla or so are available elsewhere, as are fields greater than 60 tesla with pulse lengths of a few milliseconds—much shorter than will be provided by the new magnet.

The magnet will be located at PPPL's C-Site, near the 400-megajoule motor-generator sets that will power it. The coil will be initially cooled to 80 Kelvin* using liquid nitrogen to reduce its electrical resistance. During a pulse, the magnet will be resistively heated to nearly room temperature.*

According to Chaikin, "There is a great deal of exciting physics to be done in high-magnetic fields. Interesting phenomena have been found throughout the high-field regime in several areas of our research. We have also had indications that additional phenomena would be found in magnetic fields just beyond what we now have available."

Chaikin adds, "This new coil will double the field strength presently available in direct current (dc) magnets, thus permitting experiments which are difficult or nearly impossible in millisecond pulse high-field magnets."

"For example," notes Chaikin, "magnetization measurements at pressures of more than 10 kilobars (approximately 10,000 atmospheres) are often done using a beryllium-copper clamp. Such measurements, which cannot be done in short-pulse experiments, will be possible in the new facility."

Bonanos will head the Engineering Design group for the project. He observes, "Conventional conductors and insulators, in their normal form and application, are inadequate for reliable repeated production of 60 tesla fields. In the course of this project, new materials, processes, and/or designs may be developed. These advancements may be usefully applied to fusion research, particularly to the ohmic heating of primary coils in tokamaks."

Looking to the future, Bonanos observes, "We expect other researchers from both academic institutions and industrial laboratories to request use of this magnet once it is completed. At that time, a new protocol and procedure will be required."

*Notes

Solenoid—a circular cylindrical coil consisting of tubes of conductors nesting one inside the other; when electrically energized, it produces a magnetic field.

Tesla—a unit of magnetic flux density equal to 10,000 gauss. Sixty tesla (600,000 gauss) is enormous. The earth's magnetic field, for example, is less than one gauss.

80 Kelvin (K)—approximately -315° Fahrenheit (F). (77 K is the temperature of liquid nitrogen.)

Purpose of lowered temperature—because low temperatures reduce the electrical resistivity of copper, less power will be required to reach 60 tesla. When electricity is pulsed through the magnet, the coil will reach nearly room temperature—293 K or 68 °F because electrical current heats metal as it passes through. (Were the pulse to be started a room temperature, the magnet would become far too hot.)

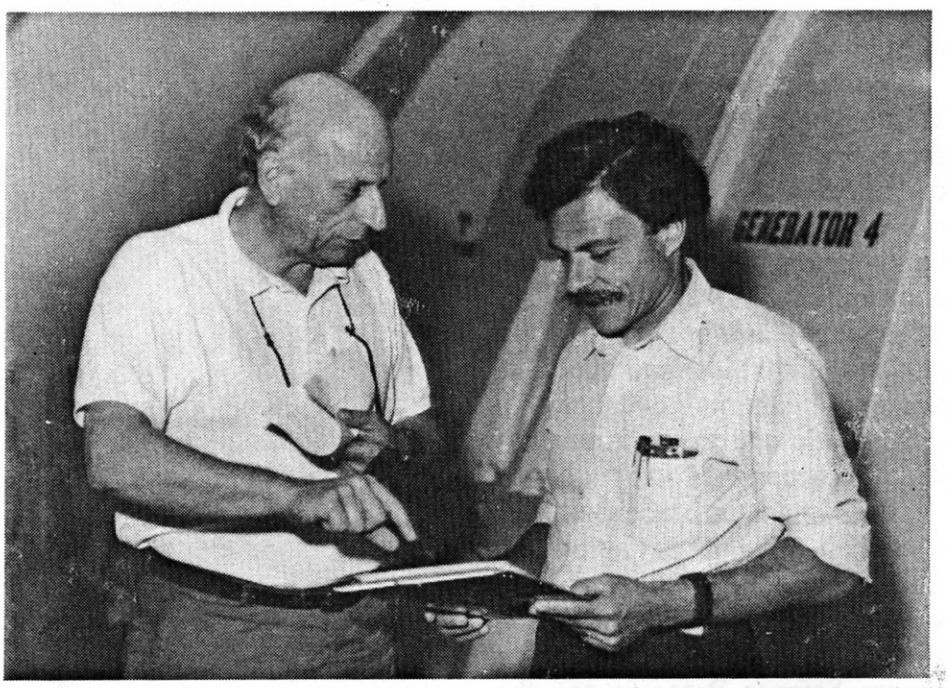


Photo: D. Applewhite

PPPL Engineer Peter Bonanos (left) and Princeton Physics Professor Paul Chaikin discuss plans for the recently funded High Field Magnet near the motor-generator sets at the Lab that will power it. Bonanos will head the Engineering Design Group.

What's Happening at PPPL?

Manos at William and Mary

Dennis Manos, Principal Research Physicist, TFTR Branch Head, and Head of Hyperthermal Atomic Beam Studies at PPPL, has recently taken a position at The College of William and Mary in Williamsburg, Virginia. Manos, who was with the Lab for 12 years, said, "It's been a joy to work at PPPL. It's not an easy place to leave."

Manos will serve as Professor of Applied Science and Physics and Director of the Applied Science Program. This is a multidepartmental, multidisciplinary (Chemistry, Physics, Biology, Math, and Computer Science) Ph.D. Program with some undergraduate presence.

In addition, Manos will be a Visiting Scientist at the Department of Energy's CEBAF (Continuous Electron Beam Accelerator Facility) and at NASA Langley Research Center. The Applied Science Program he directs at William and Mary employs adjunct research and teaching faculty from CEBAF and Langley to span the major tracks of study, which include: atmospheric science; accelerator physics; non-destructive testing; surface and materials science; polymer science; and patent law.

Shoot Some Hoops

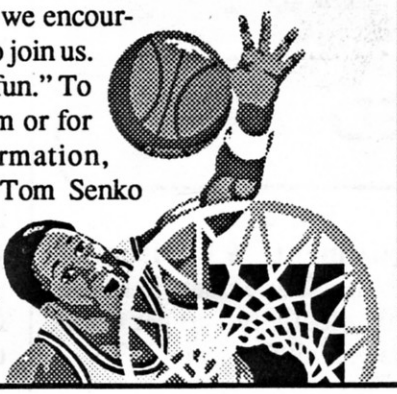
Basketball Team Wants You!

Fall is nearly upon us, and it's time to sign up for PPPL basketball. Organizer Tom Senko says, "We welcome men and women, graduate students and long-time employees. Anyone who loves basketball is invited to join the team. We want to accommodate everybody, so if enough people of different skill levels and interests sign up, we could enter more than one team."

"We're always looking for new talent," adds Ted Terpstra, who has been on the Lab team for ten years. "We've fielded some good teams in the past, and we'd like to make the playoffs this year."

According to Senko, The team will play in the Princeton Intermurals, with games either at Dillon or Jadwin Gymnasium on the Princeton campus. Seven games are to be scheduled between November and January, with intermittent practices.

Observes Terpstra, "We're a very social group. We often go out and celebrate after the games, and we encourage others to join us. It's a lot of fun." To join the team or for more information, please call Tom Senko on extension 2126 before the end of September.



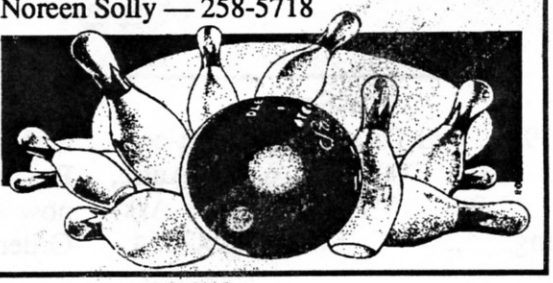
Like to Bowl?

Join the PPPL League

The PPPL Mixed Bowling League's 12th season begins Wednesday, September 9, and new team members are welcome, according to League Secretary Elmer Fredd. He adds, "We have openings for men and women on both the regular team and as substitutes. Accomplished as well as very average bowlers are invited to join." Averages last year ranged from 103 to 182. In addition to PPPL employees, League members include family members and friends of employees, so come on out!

Says Lynne Yager, "We have had five people on each team, and all of our teams include men and women. Our longest playing woman bowler is probably Bobbie Forcier while Matt Lawson is the longest playing man."

The League plays at Colonial Lanes on Route 1 every Wednesday from 6:10 p.m. until 9:00 p.m. The season runs from September 9 through May 5, with a banquet in May to celebrate the year. If you'd like to join or need more information, contact one of the bowlers listed. Elmer Fredd — 2120; Matt Lawson — 2716; Lynne Yager — 3458; Noreen Solly — 258-5718



And the Winner Is...

A London trip for two, PPPL's 1991 United Way Grand Prize, was up for grabs again, after the first winner was unable to use the trip. So committee members got together for another drawing. Here, Edna Kalmus, left, Mary Ann Brown, and Harry Howard anticipate the winner as Dianne Intoccia draws a name. It looks like Arlene White, photo below, the new winner, already has her bag packed! (Actually, she plans to take the trip with her daughter next spring.) Congratulations Arlene, and Bon Voyage! Photos: D. Applewhite and D. Krause

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1986 Ford Taurus GL; Mint-condition, 25,000 miles, 6 cyl., Auto., A/C, P/B, P/S, P/W, and more. Asking: $5,500. Call Irving at x2054.

For Sale

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TRANSITIONS

Promotions

Congratulations to three recently-promoted employees in the Emergency Services Unit (ESU).

Ron Ciraolo has been promoted to the position of Driver/Operator. He was previously an ESU Officer.

Bob Lamb has been promoted from the position of Driver/Operator to that of Fire Captain.

Steve Scholey has been promoted to Driver/Operator from his previous position as ESU Officer.

New Hires

We welcome these recently hired PPPL employees in the following areas:

Director's Office

Sharon Sherman, Science Education Program Leader

Emergency Services Unit

Allen Davis, ESU Officer
Francis McDonnell, ESU Officer
Mary Parrillo, Staff Assistant

Environment, Safety, & Health

Joseph Smith, OSHA Engineer

Procurement

Scott Loughery, Buyer

Research

Helmar Adler, Research Physicist

Births

Congratulations to ***Michael Anderson*** of TFTR D-T Engineering and his wife Anne Marie on the July 24 birth of their baby girl Kelsi.

Retirement

William Warrack, a Machinist in the Lab's Vacuum Shop retired after 28 years of service. Warrack was employed at the Princeton University Machine Shop until 1988 when he transferred to PPPL.