

HOTLINE

The Princeton Plasma Physics Laboratory is a United States Department of Energy Facility

The Laboratory is on a "Good Course"



Describing the "State of the Laboratory" on October 14 in the MBG Auditorium, PPPL Director Rob Goldston told staff, "We are on a good course." Goldston drew an analogy between a speedboat and the Lab and discussed PPPL's external affairs, scientific program, and internal operations, as well as how "we're going to keep this boat going." The talk was followed by the presentation of the Kaul Award and the PPPL Distinguished Research and Engineering Fellowships. Anyone who would like to view the address may borrow a videotape of it by contacting Sonja Patterson at ext. 2220. At right is Goldston. At top left is the speedboat the Director showed during the address. Above are employees enjoying cake and conversation at the reception in the Lobby following the address. At top right are staff at the talk.

PPPL Names Scientists Fu and Nazikian as the 1998 Kaul Foundation Prize Recipients

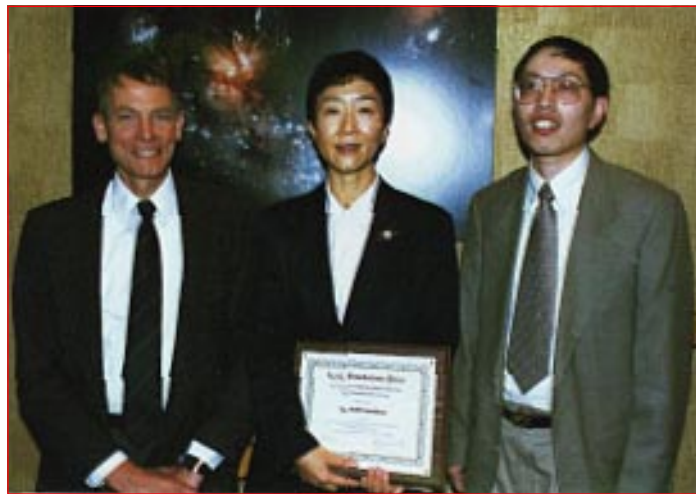
PPPPL physicists Guo-Yong Fu and Raffi Nazikian are the 1998 recipients of the Kaul Foundation Prize for Excellence in Plasma Physics and Technology Development. Fu, along with Nazikian's wife, Fumiko, accepted the awards during a ceremony and reception at PPPL on October 14. Nazikian was in Japan working on experiments at the Japan Atomic Energy Research Institute at the time of the ceremony.

Fu and Nazikian were cited "for their work leading to the discovery and understanding of alpha-particle-driven Toroidal Alfvén Eigenmodes (TAEs) in the Tokamak Fusion Test Reactor (TFTR)." This discovery is helping scientists gain an understanding of the magnetic confinement of hot, ionized gases known as plasmas at the temperature, density, and duration required for the controlled production of significant amounts of fusion energy. TFTR was PPPL's flagship experimental fusion machine for 14 years, concluding experiments in 1997.

"Raffi and Guo-Yong are being honored for an exceptional accomplishment, which is a fine example of close collaboration between theoretical and experimental physicists, leading to new insight into the physics of high-temperature plasmas," noted PPPL Director Rob Goldston.

Will Happer, Chair of the Princeton University Research Board, presented the citations to Fu and Mrs. Nazikian during the awards ceremony.

The Prize is awarded by Princeton University to recognize a recent outstanding technical achievement in plasma physics or technology development by a full-time, regular employee of PPPL. It includes a cash award of \$2,000, which is divided equally between the two honorees. Nominations for the award are submitted to the Prize Selection Committee, which includes the Princeton University Provost, the Chair of the Princeton University Research Board, the PPPL Director, PPPL Deputy Direc-



Will Happer, Chair of the Princeton University Research Board, presented the Kaul citations to recipient Guo-Yong Fu and to Fumiko Nazikian, who accepted on behalf of her husband, Raffi. From left are Happer, Mrs. Nazikian, and Fu.

tor, and PPPL Chief Scientist. Former PPPL Director Ronald C. Davidson created the prize by directing that \$40,000 of the \$100,000 gift he received as the 1993 recipient of the Award for Excellence in science, education, and physics from the Kaul Foundation be given to Princeton University to endow the Kaul Foundation Prize for Excellence. This is the second time the prize has been given. The first was in 1996 to Richard Hawryluk, who is now the Deputy Director at PPPL.

Fu

Fu came to PPPL in 1992 following a research fellowship at the Centre de Recherches en Physique des Plasmas in Lausanne, Switzerland. Fu received a bachelor's degree in physics from the University of Science and Tech-

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HOTLINE

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The HOTLINE is issued by the Princeton Plasma Physics Laboratory, a research facility supported by the United States Department of Energy. It is primarily an internal publication. Correspondence and requests to reprint material should be directed to the Editor, PPPL HOTLINE, P.O. Box 451, Princeton, NJ 08543; Interoffice correspondence should be addressed to Room B366, LSB Bldg., C-Site; fax 609-243-2751; telephone 609-243-2757; e-mail pwieser@pppl.gov

Kaul

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nology of China in 1983 and a Ph.D. in physics from the University of Texas at Austin (UTA) in 1988. He was a postdoctoral fellow at the Institute for Fusion Studies and Center for Fusion Engineering at UTA from 1988 to 1989.

Upon receiving the prize, Fu said, "It is a great honor for me to be chosen for this prize among this group of outstanding researchers at PPPL. Many people worked very hard in making this experiment a great success. This award is really for each of them."

Nazikian

Nazikian joined PPPL's research staff in 1989 and became the Laboratory's Energetic Particle Science Focus Group Leader in 1997. He received a bachelor's

degree in Science from Melbourne University in Australia in 1984 and a Ph.D. from Australian National University in 1989, where he was a Commonwealth Scholar.

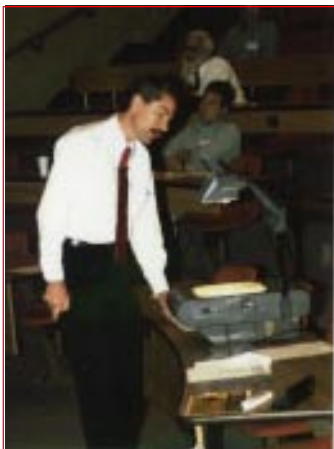
Nazikian said, "The discovery of alpha-particle-driven TAE modes would not have been possible without the dedication and total commitment of the TFTR team. It was a privilege to work on the TFTR project alongside so many talented theorists, experimentalists, engineers, and technicians. I am particularly indebted to Stewart Zweben, who got me interested in alpha-particle instabilities, and to Guo-Yong Fu, who never gave up on his theories." ●



Raffi Nazikian

Magnetic and Inertial Fusion Meeting

PPPL Hosts First MFE/IFE Gathering



Above left, Ian Hutchinson of MIT discusses "Burning Plasma Experiments." Above right, participants listen to a presentation in the MBG Auditorium.

More than 125 people attended the first Magnetic Fusion Energy-Inertial Fusion Energy (MFE-IFE) Technical Workshop held at PPPL in September. Attendees from more than twenty-five U.S. institutions participated in the three-day workshop, which included twenty-two presentations on topics ranging from "Plasma Confinement and Exhaust" to "Direct-Drive Target Designs." PPPL Advanced Reactor Concepts Head Dale Meade, Keith Thomassen of the Lawrence Livermore National Laboratory, Steve Bodner of the Naval Research Laboratory, and Roger Bangerter of the Lawrence Berkeley National Laboratory organized the workshop.

Laboratory Awards Two Physicists and One Engineer Distinguished Fellowships

Lee, Mazzucato, and Ku Receive Honors during Formal Ceremony at PPPL

In recognition of their excellence in research and in engineering, two physicists and one engineer at PPPL have been named PPPL Distinguished Fellows for 1998. The Distinguished Research Fellows are W. Wei-li Lee and Ernesto Mazzucato and the Distinguished Engineering Fellow is Long-Poe Ku. The recipients were honored during a formal ceremony on October 14 at the Laboratory.

The Distinguished Research Fellow Program, which is funded by the Department of Energy (DOE), was created in 1993 to recognize members of the Laboratory's Research Staff. Fellowships are awarded to those who have achieved extraordinary records of creativity and accomplishments in research over an extended period of time. The Distinguished Engineering Fellow Program was created in 1995 to honor members of the engineering and scientific staff who have achieved outstanding records of innovation and accomplishment in engineering over an extended period of time. Fellows receive one-time gifts of \$5,000 and qualify for priority in regard to their research and engineering programs.

The Distinguished Research Fellows, Lee and Mazzucato, were cited for their "excellence in theoretical and experimental plasma physics research at PPPL."



From left are 1998 PPPL Distinguished Research Fellows W. Wei-li Lee and Ernesto Mazzucato with PPPL Director Rob Goldston and 1998 Distinguished Engineering Fellow Long-Poe Ku. The recipients were honored at a formal ceremony at the Laboratory in October.

Lee

Lee, a Principal Research Physicist, was honored "For pioneering research in the development of gyrokinetic particle simulation and delta-f technique for studying low-frequency phenomena in magnetically confined plasmas, and for contributions in relativistic particle simulation in intense ion beam research."

Lee received a bachelor's degree from the National Taiwan University in 1962, a master's from Duke University in North Carolina in 1965, and a Ph.D. from Northwestern University in Illinois in 1970.

After working as an accelerator physicist at Fermi Laboratory in Batavia, Illinois, for four years, he joined PPPL's Theory Division in 1974. He became a Fellow of the American Physical Society's Division of Plasma Physics (APS-DPP) in 1992 and is the author of more than 70 scientific papers in magnetic fusion and accelerator research.

Mazzucato

Mazzucato, a Principal Research Physicist, was cited "For outstanding contributions in density fluctuation measurement in magnetically confined plasmas, innovative diagnostics in microwave scattering, reflectometer, and Thomson scattering, and formulation of transport models."

Mazzucato received a degree in physics from the University of Padua in Italy in 1960 and a Libera Docenza in plasma physics from the University of Rome in Italy in 1970. He came to PPPL in 1972 after working as a research physicist at the Laboratorio Gas Ionizzati in Frascati, Italy, from 1968 to 1972. He is an APS Fellow and the author of about 200 publications.

Said PPPL Director Rob Goldston, "Wei-li Lee and Ernesto Mazzucato make an excellent pair of Research Fellows to honor this year. Dr. Lee invented the 'gyrokinetic' technique of plasma simulation, which has given us tremendous new insight into plasma turbulence, when it is implemented on fast modern supercomputers. On the other other hand, Dr. Mazzucato pioneered the direct experimental measurement of plasma turbulence in our hot fusion plasmas, and it is the combination of the

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Fellows

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fields of research they began which has given us new confidence in our understanding of fusion plasmas.”

Ku

Ku, a Principal Engineer, was honored “For extraordinary creativity, capabilities, and accomplishments in developing and applying advanced analysis methods in a wide range of technical areas, which include experimental fusion devices, electron lithography, and the optimization of stellarator plasma configurations.”

Ku, who came to the Laboratory in 1977 as a post doctoral fellow, received a bachelor’s degree in nuclear engineering from the National Tsin-hua University in Taiwan in 1970 and a master’s and Ph.D. in nuclear engineering and applied physics from Columbia University in New York in 1976. He is the author and co-author of more than 60 publications.

“Dr. Ku is a tremendously versatile engineer. He has worked on a wide range of engineering problems — from studying how to provide radiation shielding of sensitive

equipment to predicting electron trajectories in lithography machines. Most recently he has been doing ‘plasma engineering’ — using the most sophisticated computer codes to optimize the design of a new fusion experiment,” said Goldston.

Approximately ten PPPL Distinguished Research Fellows and five Engineering Fellows are expected to be appointed by the end of the decade. Eight Research Fellows have been named at the Laboratory since the program was established. They are Chio-Zong Cheng, Russell Hulse, Masayuki Ono, James Strachan, Roscoe White, Masaaki Yamada, Michael Zarnstorff, and Stewart Zweben. Three Engineering Fellows have been appointed since 1996. They are Peter Bonanos, Philip Heitzenroeder, and Robert Woolley.

Fellows are expected to devote most of their time to active research and engineering activities. They will describe their work during regularly scheduled colloquia. The Research and Engineering Fellows form the Distinguished Research Fellow Council and the Distinguished Engineering Fellow Council, respectively, which advise the Director on the scientific and engineering direction of the Laboratory. ●

Powerful Computers Advance Fusion Research at the Laboratory

By Anthony De Meo

Scientists at PPPL report a major advance in the computer modeling of fusion plasmas in the September 18 edition of *Science*. The new results were obtained utilizing the Massively Parallel Processing (MPP) capabilities of the DOE’s National Energy Research Scientific Computing Center (NERSC) at the Lawrence Berkeley National Laboratory (LBNL) in Berkeley, California.

In general, the formation of stars results from the dynamic behavior of hot ionized gases known as plasmas. Fusion researchers use magnetic fields to confine such hot gaseous fuel at the temperature, density, and duration required for the controlled production of significant amounts of fusion energy. However, turbulence can spoil the efficiency of this approach by causing accelerated loss of particles and energy from the plasma. As pointed out in a Perspectives article in the same issue of *Science*, good news from toroidal confinement experiments indicates that the suppression of turbulence can enable transitions

to newly discovered enhanced confinement regimes.

In the work reported in *Science* this week, PPPL scientists have used the full power of the SGI/Cray T3E supercomputer at NERSC to create three-dimensional nonlinear particle simulations of microturbulence in the plasma. The use of NERSC’s massively parallel processor capabilities enabled scientists to perform calculations involving 400 million plasma particles (i.e., 100 million guiding centers) in 5,000 time-steps — an achievement impossible without the use of powerful MPP computers.

“The information obtained from these advanced computer simulations is providing valuable new physics insights and correlates well with trends observed in experiments. This work builds on the excellent knowledge base developed internationally and complements related research efforts at other national laboratories, such as

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Computers

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Lawrence Livermore National Laboratory and General Atomics [both in California], as well as at universities such as UCLA and the University of Colorado,” noted PPPL’s Chief Scientist, William M. Tang. “The results in our *Science* article help support the increasingly accepted position that high-performance scientific computing has matured to a level where it can be considered a new tool for discovery, complementing traditional theory and experiment. It is evident that plasma science, along with many other fields, will benefit greatly from the development of the advanced computational capabilities envisaged and strongly encouraged at the DOE/National Science Foundation Workshop on Advanced Scientific Computing held this July at the National Academy of Sciences.”

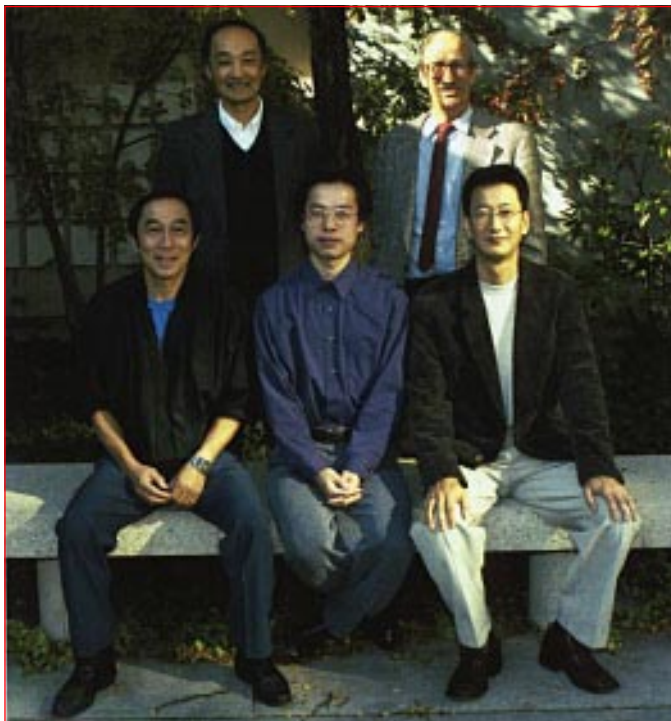
Powerful Unclassified Supercomputing Center

NERSC was originally established in 1974 to support fusion energy research programs sponsored by the DOE. The center, one of the nation’s most powerful unclassified supercomputing centers, provides both computational resources and technical support to researchers at PPPL, as well as a wide range of research efforts in various scientific disciplines at other DOE sites.

“These results are exciting in that they again demonstrate the value of computational science as a complement to experimental science. It’s particularly exciting that this significant fusion result was achieved using a highly parallel computing system.”

**—William Kramer
NERSC Deputy Director**

“These results are exciting in that they again demonstrate the value of computational science as a complement to experimental science. It’s particularly exciting that this significant fusion result was achieved using a highly parallel computing system,” said William Kramer, Deputy Director of NERSC. “We’re also pleased to see that NERSC continues to play a critical role in helping plasma physics scientists make new advances in the field. Col-



PPPL scientists involved in using the full power of the SGI/Cray T3E supercomputer at NERSC to create three-dimensional nonlinear particle simulations of microturbulence in the plasma are, from left, (standing) PPPL Chief Scientist William Tang and Roscoe White; and (seated) W. Wei-li Lee, Zhihong Lin, and Taik Soo Hahm.

laborations such as this really are the future of large-scale scientific research.”

NERSC (www.nersc.gov) provides high-performance computing services to DOE’s Energy Research programs at national laboratories, universities, and industry. The DOE’s LBNL (www.lbl.gov) conducts unclassified research and is managed by the University of California.

Editor’s Note: The citation for the PPPL *Science* article is: “Turbulent Transport Reduction by Zonal Flows: Massively Parallel Simulations,” Z. Lin, T.S. Hahm, W.W. Lee, W.M. Tang, and R.B. White, *Science* **281**, (1998) 1835. There is also a Perspective article by Keith Burrell of General Atomics Corporation and a highlight of the article in the same issue of *Science*. Copies of the article are available from Information Services and can be obtained by calling ext. 2750. ●

Rush Holt, former Assistant Director of the Laboratory, was elected to the 106th U.S. Congress. He will represent the 12th district in New Jersey. Congratulations, Rush!

PPPL Operates Exhibit at World Energy Congress



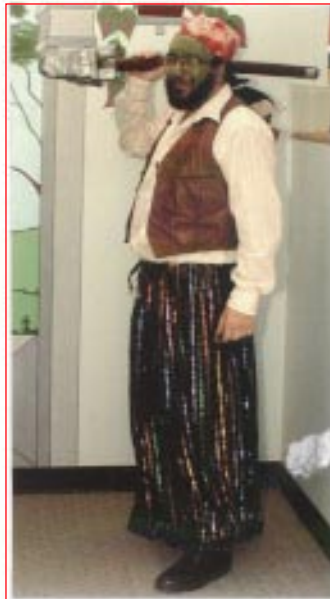
PPPL coordinated a community fusion display (at far left) for the 17th World Energy Congress in Houston in September. PPPL External Affairs Head John DeLooper, along with PPPL's James Morgan and William Hogan of the National Ignition Facility, participated in the event. The display included the topics: why fusion, what is fusion, research facilities, spin offs, and science education. At left, DeLooper (right) discusses fusion with a visitor at the display. Representatives from 90 countries participated in the Congress, which drew about 8,000 people.

New DMAC Group



The Director's Minority Advisory Committee (DMAC) for this year includes, from left, Susan Murphy-LaMarche, Linda Harmon, Joe Winston, Chairperson Arlene White, John Clark, Virginia Finley, Pamela Lucas, and Bob Kaita. Not pictured is Council Advisor John Schmidt. Please contact any of the members if you have issues you would like to bring to the attention of the Committee.

Employees Dress up for Halloween



On the Friday before Halloween, many PPPL staff members came to work in costume at the urging of Lab Director Rob Goldston. Above left is Goldston and above right are John Bennevich (left) and Bobbie Forcier.

Thank You

My family and I would like to thank everyone for the sympathy and kindness extended to us following the death of my mother. Your many notes, kind words, mass cards, and donations given in her memory are deeply appreciated.

— Patti Wieser



Let's Get Physical



The new Fitness Center at PPPL opened in October in Room A-105. It is in the former Training Room and includes two treadmills, a step machine, two rowing machines, a Universal machine, a cardio-glide, two exercise bicycles, and weight areas. Members of the Maintenance and Operations Division completed the center, which is open around-the-clock. PPPL Director Rob Goldston (center) tries out the treadmill while Human Resources Deputy Director Susan Murphy-LaMarche (left) and ES&H and Infrastructure Support Head J.W. Anderson cut the ribbon marking the opening of the center.

Dateline New York City: November 1, 1998

by Steve Jardin

I ran in the New York City Marathon on November 1, along with about 30,000 others from around the world. It was quite an experience, certainly one that I will remember for a long time. I finished the 26.2-mile course in 3 hours and 51 minutes, which was a bit slower than the 3 hours and 30 minutes I was shooting for (to qualify for the Boston Marathon), but was still in the top one-fourth of the finishers.

It was a beautiful day, and the entire route was lined by thousands of cheering crowds, including dozens of bands, and many, many volunteers handing out water, oranges, and other treats. The race went through all five Boroughs, across five bridges, and through many ethnic neighborhoods. I personally enjoyed the first 13 miles immensely, but started getting tired during the second half, and almost had to drop out when my muscles suddenly began to cramp at about mile 17 or 18. I somehow found some way to run through this period, although quite slowly for a while, but I felt really horrible the last six or so miles. I was never so happy as when I crossed the finish line and

the other runners in the shoot started congratulating each other and they gave the finishers medals and blankets to stay warm. I lost more than five pounds during the race, even though I got water at just about every water stop.

I started moderately serious running training about a year ago. My original motivation was just for health and to control my weight, but I soon realized that I needed a goal to keep it up. I had always wanted to run a marathon, and so I applied to the NYC Marathon in the spring. I was accepted during the summer, by lottery, after I had almost given up hope and had actually been accepted to another marathon, which I then withdrew from. For the past three to four months I have been running 40-45 miles a week, including a Sunday morning run which I have built up to 20 miles.

I still want to run in the Boston Marathon, which means that I have to qualify by running 3:30 in another marathon. I'm starting to train again, but this time will add some additional high-speed "interval" workouts to help me get into the lower time bracket. I now have new respect for marathon runners, especially the fast ones. They're also really a great bunch of people, and always have the desire to do better. ●