DOE Princeton Plasma Physics Laboratory

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HOTLINE

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

Orbach Attends PPPL On-site Review

DOE Office of Science Director Ray Orbach heard about PPPL's vision for the next ten years during the "On-site Review" at the Lab on September 29. This vision encompasses the National Compact Stellarator Experiment completing construction and coming into operation at C-Site in 2007; the National Spherical Torus Experiment completing its mission by this time, with the Lab possibly moving on to a Next Step Spherical Torus in the former Tokamak Fusion Test Reactor Test Cell; and the construction in the next few years of a West Wing Addition to the Lyman Spitzer Building. The addition would be proposed to house both the U.S. ITER Project Office and a joint PPPL-GFDL-Princeton University computer center.

Facing the camera, from left, are DOE Office of Science Director Ray Orbach, Toni Joseph, Director, Office of Laboratory Policy for the DOE Office of Science, and PPPL Director Rob Goldston (standing). At far right with his back to the camera is PPPL Chief Scientist Bill Tang.

"We discussed in detail how the elements of the plan each fit into the FESAC [Fusion Energy Science Advisory Committee] 35-Year Development Path for fusion," said PPPL Director Rob Goldston, who gave the morning presentation. "Dr. Orbach received the Lab's plan enthusiastically." The afternoon of the review included a discussion about project management, infrastructure and security, safety, and workforce issues, led by PPPL Deputy Director Rich Hawryluk. "Dr. Orbach expressed appreciation for our progress on safety and encouraged further advances. He clearly understands all the operating issues that all the DOE Labs face," said Goldston. ●

PPPL Researchers Study Plasma Sterilization

By Anthony DeMeo

Hundreds of billions of plastic food and beverage containers are manufactured each year in the U.S. All of these packages must undergo sterilization, which at present is done using high temperatures or chemicals. Both of these methods have drawbacks. Chemicals often leave a residue that can affect the safety and taste of the product, and produce undesirable waste. Heat is effective and sufficiently rapid, but necessitates the use of costly heat-resistant plastics that can withstand sterilization temperatures. What if a new method could be found that eliminated the need for chemicals or heat-resistant plastics?

Plasma just might be the answer. At PPPL, a team is conducting a small-scale research project studying plasma sterilization. This method, if successful, could be used to

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At left is John Schmidt, lead scientist for the Plasma Sterilization project, next to the experiment. Above at the plasma sterilization experiment are, from left, Gary D'Amico, Nevell Greenough (kneeling and looking into sterilization apparatus) and Lewis Meixler. The experiment is on the first floor of the L-wing. Below is a sketch of the plasma sterilization apparatus.

Sterilization

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sterilize food and beverage containers, leading to an enormous savings — potentially hundreds of millions of dollars annually for a large soft drink manufacturer.

New Plasma Approach

"We have experiments indicating it is possible to kill microbes using a new plasma approach," noted John Schmidt, lead scientist of PPPL's Plasma Sterilization project. Schmidt cautioned, however, that the research is preliminary. "These experiments need to be published, peer reviewed, and repeated by other researchers to assure reliability. Physics research will be followed by considerable development work to arrive at a practical system for assembly line use," said Schmidt, who has been awarded a patent for a plasma sterilization system [see apparatus shown in sketch at right]. Working with Schmidt are PPPL Technology Transfer Head Lewis Meixler, physicist Doug Darrow, engineer Nevell Greenough, and technicians Gary D'Amico and Jim Taylor.

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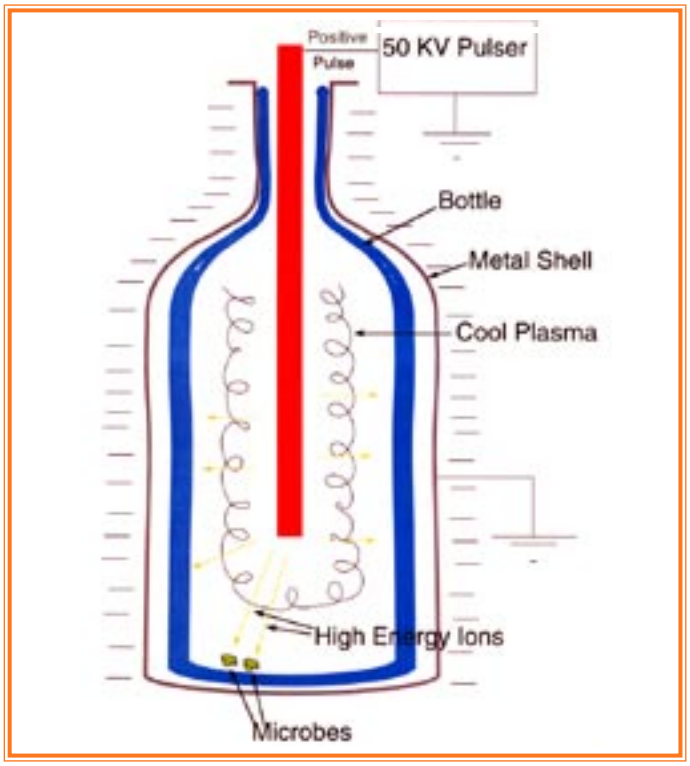

Hotline

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The PPPL Experiment

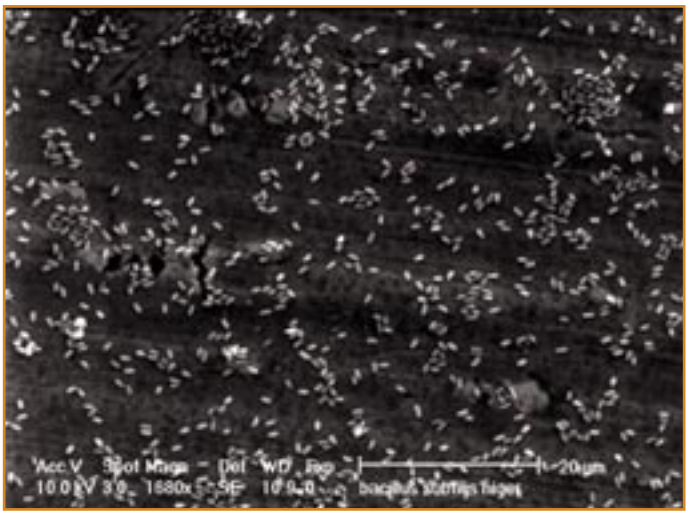
To get started, PPPL researchers modified old equipment that had once been used to study radio-frequency (RF) waves for fusion applications. It consisted of a vacuum chamber equipped with an RF source. A brass sphere measuring one inch in diameter was mounted at the center of the chamber. In preparation for experiments, the sphere is removed and sent to a commercial biological testing laboratory in Hightstown where a known number of spores of bacillus subtilis, a non-toxic microbe commonly used as a standard in lab testing, are placed on its surface. Following an experiment, the sphere is returned to Hightstown where technicians determine the number of spores killed in the process.

Fusion experiments at PPPL have generated plasmas with temperatures in the hundreds of millions of degrees centigrade. For killing spores, the PPPL researchers start with "low-temperature" hydrogen plasmas in the range of 50,000 degrees centigrade. At that temperature, the hydrogen ions are moving much too slowly to kill spores quickly. Rapidly pulsing a 50-kilovolt potential between the sphere and the vacuum chamber solves the problem. The sphere is charged negatively and the vessel is at ground. Under these circumstances, the positively charged hydrogen ions accelerate toward the sphere in pulses energetic enough for the ions to pierce the hard outer shell and soft inner core of the spore. Recent experiments employed 4,000 10-microsecond pulses, which reduced the population of live spores by a factor of 100-1000 — the kill ratio.

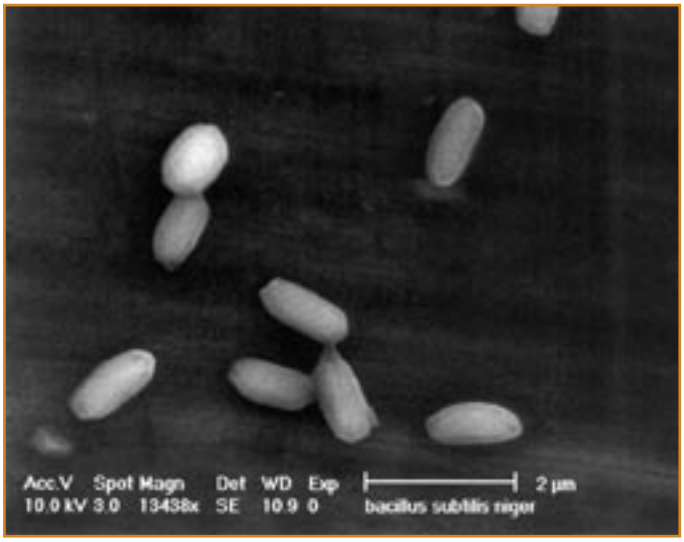
In the Real World

In the real world, equipment and processes suitable for the assembly line of a packaging plant would be needed. In such a situation, sterilization time is precious. RF generates a low-temperature hydrogen plasma inside the evacuated container, which is held in place by a surrounding conducting shell. An electrode is inserted into the container. The plasma is then subjected to a pulsed differential of 50 kilovolts, with the electrode pulsed positively and the conducting shell grounded. This causes energetic pulses of hydrogen ions to accelerate away from the electrode toward the conducting shell. On the way, they collide with spores present on the inner surface of the container. The hydrogen ions are energetic enough to penetrate the durable proteinaceous outer cover of the spores.

"These high-energy hydrogen ions stop very quickly and consequently deposit all their energy over a very small distance, a few microns, which, as it turns out, is the size of the spores. So relatively modest currents of energetic hydrogen ions can do a large amount of damage inside the spores by messing up their DNA," said Schmidt. He estimates that a sufficient kill ratio could be attained by 10-microsecond pulses every millisecond for a few seconds. Further experimentation is needed to confirm the number of 10-microsecond pulses necessary to reach the required kill ratio. A few seconds processing time per container would make the system feasible for the assembly line.



Shown is an example of the spores used in the plasma sterilization experiment. The image, made by a scanning electron microscope, is of bacillus subtilis var Niger spores magnified approximately 1,700 times. It illustrates the typical spore density on the surface of the brass sphere that is inserted into the sterilization apparatus, and shows that the spores are fairly evenly distributed over the surface to be sterilized.



Shown is a scanning electron microscope image of a small group of bacillus subtilis var Niger spores magnified approximately 13,500 times. The image shows that the spores are approximately 1 µM long and approximately 0.5 µm in diameter.

The effectiveness of the hydrogen ions can be compared with that of gamma rays or X-rays used to sterilize bulk materials. Gamma and X-rays have long penetration depths, so they don't do as much damage per unit length as the hydrogen ions. "Textbooks contain the radiation damage coefficients that are required to kill the relevant microbes. I am confident that we will be able to attain these," said Schmidt.

A small business has been started to do the development work leading to a potential commercial application. ●

PPPL's Silber Scouts for Next Baseball Great

When there's a glitch in one of the Lab's UNIX Cluster computer systems, PPPL's Kenny Silber steps up to the plate. But on a baseball field after hours, Silber stays far behind the plate — in the stands, to be precise—checking out high school and college baseball players to see who can pitch a ball with a blazing speed or hit with outstanding power.

Kenny Silber, equipped with a radar gun, scouting at an area baseball game.

Silber is a scout for the Chicago Cubs, or, as he more aptly describes himself, a "bird dog." Armed with a radar gun and timing watch, he is on the lookout for the next Babe, Sammy, or Derek.

"I cover New York and New Jersey college and high school ball in the spring, and local collegiate summer leagues," said Silber. "I also look at some American Legion baseball teams, which are made up of high school players."

Identifying Players with Potential

From spring through summer, he attends about 30 games, identifying players with potential and following up on the leads of Chicago Cubs Northeast Head Scout Billy Blitzer. "I operate through Billy, who has put several players in the big leagues," said Silber. "Most of the time, I provide a second evaluation of the players Billy has identified as having potential. Our scouting is a joint effort."

So what does Silber look for when trying to find the next great pitcher, short-stop, or left fielder?

"If you are scouting for a 'rightie' pitcher, generally you would look for someone who is at least six feet tall and can throw a minimum of 90 miles per hour," said the baseball scout. "A leftie's velocity could be a little less, but in either case, the pitcher should have good arm action and mechanics."

Catchers need other characteristics and abilities, such as physical size, and, most importantly, the ability to throw well to second base. "A catcher with homerun power is a plus, but they don't need to run well," noted Silber.

With first and third basemen, it's all about hitting with power, and Silber gets to the field before a game to watch the players at batting practice so he can evaluate ther power hitting potential. A third baseman's foot speed in the field is also very important.

Then there are the short-stops — some of the best athletes on the field. "The first thing you look at is their arm strength and fielding ability. Next you look for running speed, and then how well they swing the bat," said the scout, adding that the same capabilities, minus arm strength, are scouted in second basemen.

Out fielders need to be able to hit well, hit with power, and run. Center fielders must run very well and be good in the field, and left fielders must either hit for power or have a high batting average. Left fielders generally have the weakest arms in the outfield, while right fielders usually have the best throwing arms.

Silber added that scouts vary on how they evaluate players, and teams differ in what they are looking for, often putting out specific guidelines for positions. Silber, who follows his own nose and Blitzer-inspired guidelines for different positions, stressed the importance of keeping careful records on players and their abilities. "The most important thing is to pay attention when you are at games and tryouts, and to keep careful notes. You may only get one chance to see a player, and you must write everything down," he said.

Silber has had a lifelong passion for baseball, whether it involves playing, coaching, or scouting. As a kid growing up in Brooklyn, he used to play the same game Willie Mays mastered as a youngster — stickball. "It was good training for playing baseball," said Silber, who hails from a family of baseball enthusiasts, including his parents, three brothers, and two daughters, as well as a supportive wife.

PPPL's Kenny Silber on the field during his Princeton University baseball coaching days.

Silber played baseball and basketball in high school and college, and after he graduated from Brandeis University outside Boston, he coached summer baseball in Plymouth, Mass., and then became an assistant baseball coach at Princeton University under Hall of Fame Baseball Coach Tom O'Connell, who had been his baseball coach at Brandeis. While coaching varsity and junior varsity, and assisting in running a summer camp at Princeton, Silber accepted a job at PPPL as a contract computer programmer, later becoming a regular member of the Lab's Computer Division.

"I was doing both jobs and considered both full time," he recalled. He was at the University from 1982

Silber exposed his daughters to the game of baseball as tots. Here he is with his daughter, Lisa, when she was a baby. Lisa is now a teen.

to 1996, coaching players in more than 600 college baseball games, including during three NCAA regional tournaments. "My blood, sweat, and tears are on those fields," he said, noting that while he was at Princeton, the team won three Ivy League Titles.

When Silber left his assistant coaching position, he called Blitzer, one of the most well respected and dedicated baseball scouts in the profession, to see if Blitzer needed any help.

"I signed a contract with Billy and the Cubs as a part-time scout. It's a thrill seeing kids that you might have helped identify travel through the minor leagues and maybe into the majors," he said. Silber helped Blitzer evaluate one player at Villanova University who is now in the AAA League, a step away from the big leagues.

Silber described his work with young players, through scouting and, in particular, through coaching, as "real satisfying."

Despite all his efforts to find players for the big teams, Silber, a Mets fan after the Cubs, doesn't attend many major or minor league games, except for an occasional Trenton Thunder game. And he's not been to Wrigley Field in Chicago — home of the Cubs — ever. "Maybe this year I'll make it for the World Series," he said in early October when the Cubs were among the teams in the playoffs. "I don't really like being a spectator. I love scouting, coaching, and teaching kids," said Silber. ●

OPEN ENROLLMENT
FOR HEALTHCARE PLANS
October 20 - November 7, 2003

HEALTH COVERAGE CHANGES

Have you had a change in family status such as: marriage, birth of a child, divorce, children no longer eligible, or your spouse is now covering you with his/her employer?

The open enrollment period is your annual opportunity to change health plans, if you choose. Changes made during open enrollment will be effective January 1, 2004.

EXPENSE ACCOUNT ENROLLMENTS

Those interested in enrolling or re-enrolling in a Health Benefit Expense Account (HBEA) or a Dependent Care Expense Account (DCEA) must complete an enrollment form for calendar year 2004 during this open enrollment period.

See BOBBIE FORCIER • Human Resources • LSB B-172 • x2101

Monday, October 20 thru Friday, November 7

10:00 A.M. to 12:30 P.M. and 2:00 P.M. to 4:00 P.M.

If you are unable to see Bobbie during "Office Hours" please e-mail her at bforcier@pppl.gov

VENDOR FAIR *TUESDAY, NOVEMBER 4th • 10:00A.M. to 3:00P.M. • LSB LOBBY*

DOE Honors Fisch for Mentoring Students

Nathaniel Fisch, PPPL Associate Director for Academic Affairs, recently received the Outstanding Mentor award from the DOE Office of Science. Ray Orbach, Head of the DOE Office of Science, presented the award to Fisch at PPPL in September. The plaque, signed by Energy Secretary Spencer Abraham, recognizes Fisch for his "dedication as a mentor and for his willingness to share knowledge and to inspire and instill confidence in the next generation of scientists and engineers by setting high expectations, seeking creative solutions, and immersing inquisitive minds in the world of science." The award, issued this year, honors Fisch for his mentoring efforts in 2002. Orbach (at left) presents Fisch with the award. ●

PPPL Merchandise Mart in the Works

Soon, PPPL will be opening a merchandise mart to offer to staff T-shirts and other products emblazoned with the PPPL logo. The location will be around the corner from the Lab's history displays across from the Cafeteria. A contest for naming the "store" will be announced, and the target time for opening is before the holidays. An advisory committee, headed by Human Resources Head Susan Murphy-LaMarche, includes Mary Ann Brown, James Morgan, and Patti Wieser. Retiring Human Resources Head Steve Iverson was instrumental in getting the store off the ground.

Stay tuned to **Hotline** for the latest news on the store, contest, and merchandise offerings.

Team Gathers at PPPL for NCSX Preliminary Design Review

Above is the NCSX project team, including PPPL and ORNL staff, and the review group.

A successful preliminary design review of the National Compact Stellarator Experiment (NCSX) project was conducted October 7-9 at PPPL. The review team brought a diverse background in project engineering and management, with members from Auburn University, Brookhaven National Laboratory, Boeing Company, Fermi National Accelerator Laboratory, General Atomics, Max Planck IPP-Garching (Germany), Los Alamos National Laboratory, Massachusetts Institute of Technology, Oak Ridge National Laboratory (ORNL), PPPL, and the University of Wisconsin.

The three-day review focused on the project's design and R&D progress and its cost and schedule estimates. The project team made over thirty presentations covering all aspects of the project engineering and management. In its closeout briefing on October 9, the committee said the design is technically sound, and the cost and schedule estimates are sufficient to deliver the project scope, including adequate contingencies. The reviewers complimented the project's experienced leadership and staff and the teamwork evident among all members of the team. They highlighted the effectiveness of the ORNL-PPPL partnership in carrying out the project. They concluded that all systems are ready to baseline and that the project is ready to proceed to DOE Critical Decision 2 (CD-2), approval of the baseline. They made many valuable suggestions for improving the project's design and plans, which the project will fold into its preparations for CD-2.

The NCSX, an experimental facility, is planned as the centerpiece of the U.S. effort to develop the physics and determine the attractiveness of the compact stellarator as the basis for a fusion power reactor. It will be built at PPPL in partnership with ORNL. The NCSX is now in design and has started to fabricate full-scale prototypes of the major components. First plasma is scheduled for 2007. ●


HAPPY
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