April 2000

ON TARGET

THOMAS JEFFERSON NATIONAL ACCELERATOR FACILITY • A DEPARTMENT OF ENERGY FACILITY

William and Mary and

Lab efforts forge ahead in ARC materials characterization lab

SURA honors

Dana Hamel for years of dedicated service, support

Management development

program grows, develops to meet manager, supervisor needs

Ready, Set, Go!

Get ready for Run-A-Round festivities set for May 4

FEL Upgrade

Improving machine's capabilities to meet users' advancing needs

by James Schultz

Spring's abundant color and warming temperatures usually gladden the hearts of even the most sullen. This year, spring may prove particularly cheery for Jefferson Lab's 15-member Free Electron Laser (FEL) team. An expected $15 million from the Dept. of Defense, distributed over the next two-and-a-half years, will enable the team to begin a long-scheduled FEL upgrade. The funds follow on the heels of a $550,000 grant from the Southeastern Universities Research Association, SURA, that made possible initial project planning and startup engineering.

The upgrade will result in greater FEL capability and power. Engineers plan to install a new injector that will produce twice the amount of electron beam current than is currently possible. A new "wiggler" will double the fraction of electron-beam energy converted to laser light. Two cryomodules will be added to the FEL linear accelerator line, effectively quadrupling system energy from the current 40 million electron volts, or MeV, to 160 MeV. Laser power will surge at least 10-fold, to 10 kilowatts, and may peak near 20 kilowatts. By September 2002, says FEL program manager Fred Dylla, interested parties in both the public and private sectors should have a powerful new tool at their disposal.

"We were proud that we were able to use Lab-derived superconducting linac technology to make a very efficient one kilowatt FEL. Now we're well on our way to upping the ante," Dylla says. "At the one-kilowatt level, there are already sig-

continued on page 2

Joe Gubeli and Michelle Shinn, Free Electron Laser team members, inspect mirrors in the FEL tunnel used to extract light from the electron beam.

Upgrade will improve FEL capabilities to meet users' needs

continued from page 1

nificant scientific applications which are beginning to come out. At the 10-kilowatt level, we're confident there will be relevant defense and industrial applications, in addition to new science. We're well prepared and ready to launch into the project."

The Navy is keenly interested in a beefed-up FEL because of its potential to disrupt missile-mounted infrared guidance systems. Unlike competing systems, primarily chemical lasers, FEL lasers are electrically driven, therefore requiring no resupply of consumable chemicals in order to operate. Changeable weather poses less of a problem; FEL light can be tuned to so-called "atmospheric windows" where infrared light is most easily transmitted.

"A 10 kilowatt FEL wouldn't effect a hard kill on a missile that is first detected low on the horizon. Nothing would be physically blown apart," Dylla explains. "What you're after is disabling the infrared sensors on an incoming missile to prevent it from finding its target."

Users Will Benefit

An upgraded FEL offers significant advantages to commercial and scientific interests, not the least of which is an essential halving of per-unit lasing costs. Cheaper light means increased frequency of use and experimentation, boosting the chances of potential, near-term applications.

Thus far, FEL experiments have included investigations of assisted chemical vapor deposition, a technique used to produce high-quality coatings and thin films for electronics and microcomponents, as well as the effects of FEL processing on nylon, polyester and a class of materials known as polyimides. In addition, researchers examined the FEL's ability to act as a precisely tuned spectroscopic tool for a variety of basic science experiments involving materials science, chemistry and biology.

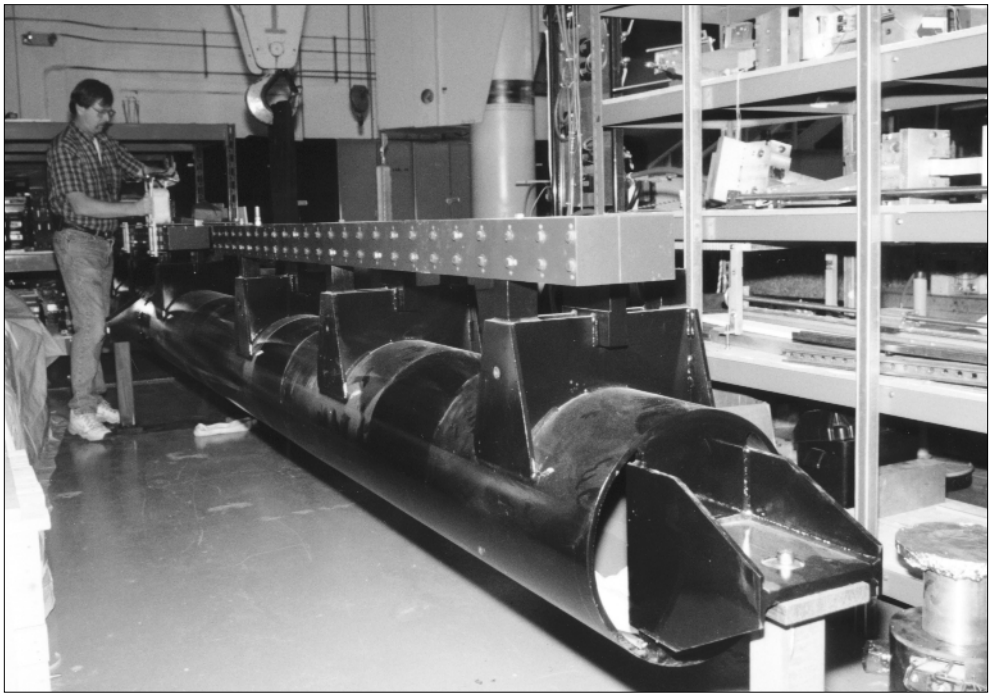
Researchers have also managed to lase FEL light at what experts define as the "fifth harmonic." Light produced at this level is the optical equivalent of an overtone perceived by the human ear during the plucking of a piano or guitar string. The practical effect is production of tuneable, short wavelengths of visible and eventually ultraviolet light, which could substantially enhance scientific applications and reduce manufacturing costs for certain products, particularly those requiring deposition of thin-films and specialty coatings.

Future FEL experiments are slated to include continued studies of how energy flows within proteins; investigations of the niceties of "spintronics," novel semiconductor designs that would employ atomic properties for optimum performance; and experiments assessing the nature and extent of the human health risk arising from increased ultraviolet light. Also on tap is scrutiny of the effects on materials of extremely fast melting of surfaces, as well as use of an upgraded FEL as an ultraprecise drill to more efficiently and cheaply make such products as printer heads and automotive fuel components.

During the FEL upgrade, the machine's present configuration will remain essentially unchanged until early 2002. Operational time will, however, be limited. Although the machine will run roughly one month of every three, researchers will nevertheless continue runs to improve understanding of present and future FEL capabilities and to permit users to install and conduct occasional experiments.

"We want to continue to expose the machine to as many high-profile experiments as we can during the operational periods," Dylla says. "So we've been advertising to the Laser Processing Consortium members that we have the machine available and it's performing well.

"We've relied on as broad a group of stakeholders as possible: defense, scientific and industrial. We've counted on all three groups for critical mass. We've managed to leverage the technology, and it's a whole new ball game for FEL development. We think everyone will benefit from the upgrade."



During the upgrade, this Northrop Grumman/AES wiggler will be installed for use by the FEL, making the FEL capable of producing 10 kW of infrared light. Don Bullard, Accelerator Division, inspects the device after it was delivered to the Test Lab.

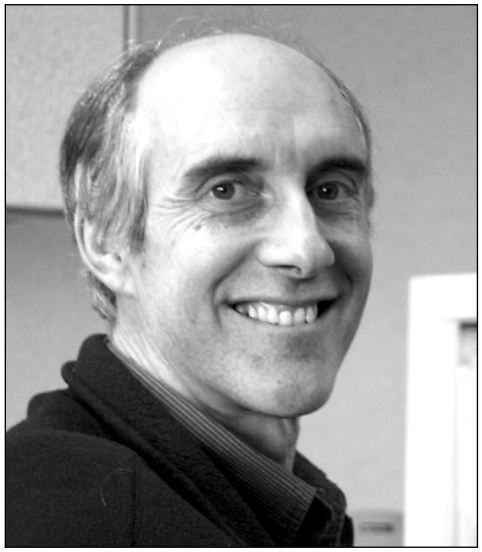
Welcome aboard!

Lab gets FEL basic research program manager

After a long search led by Christoph Leemann, JLab finally succeeded in filling a job that had gone vacant for years, that of FEL Basic Research Program Manager. This position was designed to develop a research program for the FEL and acquire the funding needed to pursue and develop those projects. Gwyn Williams joined the Accelerator Division at the beginning of March, working for Associate Director Christoph Leemann.

Williams' focus is to nurture a basic research program for the FEL, and to balance that program with the FEL's applied programs. "We have a fine machine [in the FEL] and a great infrastructure here," Williams points out. "The job before me is to convince funding agencies that there is good reason for supporting FEL research programs, and to show taxpayers that there is value in having their money spent on research here."

Williams is excited about developing the FEL's basic research program.



"Scientifically, a new tool like this nearly always brings forth major advancements in the understanding of how things work. This tool has the potential to bring about significant change," he explains. He's also looking forward to working with the materials characterization research going on amongst the Applied Research Center collaborators.

He wants to see the FEL become a full-use facility, running like CEBAF. "I'd like to eventually see the FEL running 5,000 hours a year. We currently have requests for many more beam hours than we can afford to run," he adds.

Williams left a job at Brookhaven National Lab, running six light-source laboratories. "It was a great job," he admits, "but I couldn't pass up the challenge here. It will be exciting to watch the unfolding of research developments and applications with the FEL. It's a great tool and we should get great results."

Born near Cambridge, England, Williams has been working with light sources since 1971.

When he's not at work, Williams and his wife, Jennifer, enjoy windsurfing, sailing and contra dancing (Irish folk dancing with "callers" similar to square dancing). He has three children and one grandchild.

Special Recognition

The Southeastern Universities Research Association Board of Trustees meeting was held at JLab April 17 – 18. It was the Board's first visit to the Lab in a decade. The highlight of the meeting was a recognition celebration in honor of Dana Hamel, SURA Vice President since 1982. Dr. Hamel recently announced his retirement from SURA, after decades of service to and support of the organization and the development of Jefferson Lab. In this photo from JLab's dedication on May 24, 1996, Dr. Hamel talks with then Secretary of Energy Hazel O'Leary.

Lab, W&M collaboration

Lighting the way to success in materials characterization research

by James Schultz

They're hoping to one day pinpoint the physical processes that worsen the impact of pollution, identify ways of building better printers and maybe even suggest means of quickly disposing of dangerous microbes. The tools of the trade are state-of-the-art lasers and unique light sources that affect and change the materials, chemicals and cells they touch. For researchers at the Applied Research Center, the focus is on practical problem-solving that will have a near-term payoff and yet provide long-term insight into processes that, to date, remain elusive.

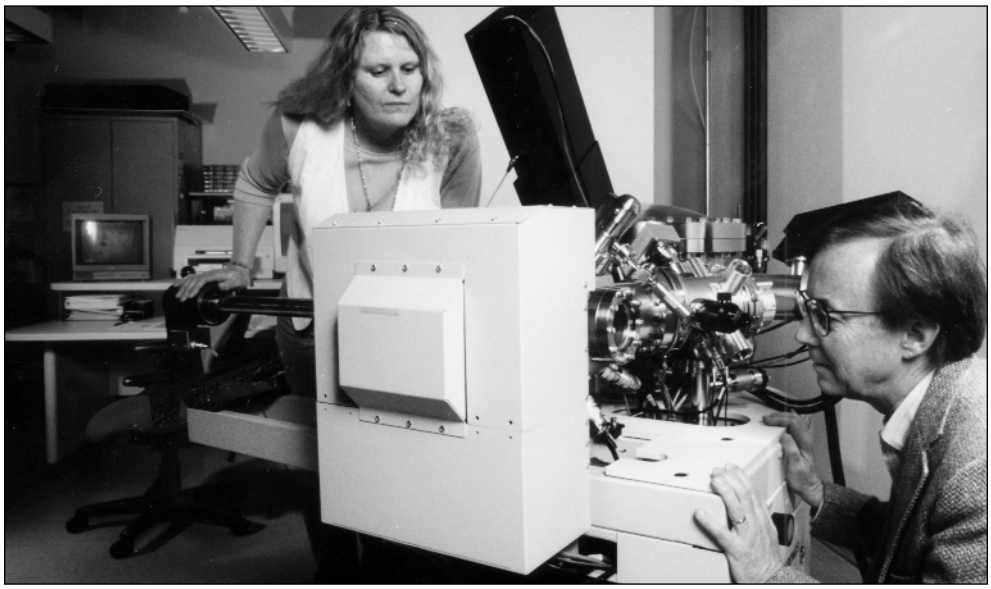
"Light is a marvelous but underutilized tool for both inquiry — to learn what you've got — and modification of surfaces — changing what's there," says Michael Kelley, chair of the Lab's Laser Processing Consortium and of the College of William and Mary Applied Science Dept. "The type of light we could produce has been so limited and so costly that people have tended not to explore potential applications. Now things are changing and JLab is taking the lead in the development of novel light sources."

Kelley's joint appointment reflects the close and ongoing collaboration between JLab and ARC university members: William and Mary and Christopher Newport, Norfolk State and Old Dominion universities.

Experiments begin this month at ARC on identifying ways in which polluting substances attach and bind to the surfaces of soils. Currently, researchers don't understand important aspects of these mechanisms. If bonds are weak, then toxins could potentially be loosed into the environment. There could be active surface chemistry: toxin-material interactions that could either amplify or mitigate harmful effects. Pollutants could strongly bond with soils on the molecular or even atomic level, requiring yet other means of remediation or perhaps allowing them to remain permanently and safely immobilized.

To conduct their analyses, scientists will be using a newly purchased device known as a time-of-flight secondary-ion mass spectrometer, or TOF/SIMS. It is essentially a miniature accelerator that generates an ion beam that interacts with a small sample of soil mounted on a metallic foil. The debris produced by the collision generates a characteristic chemical signature, which is read by the device's built-in spectrometer.

"We're starting with lead, a material whose interactions we already understand a bit," Kelley says. "Then we'll move on to other substances. Eventually, these kinds of studies could lead to practical environmental-cleanup solutions."



Amy Wilkerson, senior laboratory specialist, and Michael Kelley examine the specimen chamber of the TOF/SIMS.

A List Of Promising Projects

Light-based materials processing offers a potentially cheaper, less environmentally harmful means of manufacturing. But the benefits could range well beyond the economic, to reduce illness and guard against food spoilage and contamination. Packaging, textiles and air filters treated by ultraviolet light, for instance, could alter surface chemistry sufficiently to kill harmful microbes — an especially useful innovation in confined spaces such as offices or airplanes where disease can be more easily transmitted.

More near-term, researchers using the Lab's Free Electron Laser, or FEL, have completed initial studies demonstrating the practicality of drilling the very small holes in materials used for ink-jet printer heads, with less physical damage and higher quality, in order to improve image resolution. In work not related to the FEL, they also recently completed investigations of nitrogen ion implantation of silicon, a technique that allows for more robust microchips that can survive without impairment or damage in harsh environments, such as in car engines or in washing machines.

"In everything we do, we do a business analysis. We chart a path to success," Kelley says. "We need to know where we have to get to to make our process economically viable. Eventually, we need funds for these kinds of activities. Because we expect the program to grow, we have to justify that growth in a practical way."

Whatever the outcome, and no matter the timetable for practical applications, ARC collaborators aren't losing sight of the need for basic materials-characterization research. The training of future scientists is a key priority. Kelley says that, together, the Lab and ARC intend to become one of the nation's, if not the world's, leaders in the teaching of materials-characterization science.

"What will come of this program is a generation of materials, environmental and marine scientists experienced in the use of surface-science techniques," Kelley asserts. "No one else in the world is doing what we are."

To improve skills

Management development program tackles identified needs

Jefferson Lab is taking its Management Development Program to a new level, according to Bruce Ullman, Training and Performance Manager.

Many Lab managers and supervisors are interested in improving their management and supervisory skills, Ullman said. A few years ago the Lab's Management Development Steering Committee collected information from across the Lab and created a list of the skills that were cited most often as critical for our managers and supervisors. Based upon the list, several courses were developed, including a Project Management Course that was given in 1998 and 1999.

"Now we're taking the next step and identifying the factors most important to our managers' and supervisors' performance at different levels," Ullman explained. "We are trying to differentiate the needs of senior managers, middle managers, and line supervisors. Each group identifies its most critical performance factors, and decides which of these they wish to work on. Then we will find or develop programs to meet their needs, schedule and run them, and follow-up to get feedback."

In December 1999, a core managers' workshop kicked off the effort. Ullman cited the attendance of all Lab associate directors and nearly every core manager as a testament to the high priority senior leadership gives to management development. Working in groups, they identified a series of about 50 performance factors (skills) that both senior and middle managers need to be successful at the Lab. They prioritized the list, selecting the factors most critical for job success. They are now in the process of identifying the ones that will be addressed in on-site programs, according to Ullman. These will be in place by early summer and follow-up re-assessments will take place later in the year. A similar process for line supervisors began in late February and will be in place by mid-summer.

"To be useful, the programs need to be based on specific needs," Ullman explained. Managers and supervisors have the opportunity to develop themselves with planned programs. In addition, they can build their own development plan. Using the new Web-friendly training database (mis.jlab.org/ingenium/), individuals may search for training by performance factor and register themselves for any training offered on site.

"Our managers and supervisors have unique needs. They are the best ones to identify and prioritize those needs. And, they know what types of training will work best for them. Gaining the needed skills will take place in a variety of ways: from the very informal such as mentoring and self-study to more formal activities like small group seminars and off-site training. Planned feedback every six months gives us a method to measure results." Ullman said of the new program.

Research Update

Bob Austin, Dept. of Physics, Princeton University, adjusts his research apparatus he used recently in the FEL User Facility for studying energy flow in proteins. This marked the first time JLab's FEL was used for this type of research, and is expected to be a growth area for future FEL use.

Ready, Set, Go!

Run-A-Round festivities near; plan to take part in event

Spring is here and that means it's time to pull out the shorts and dust off the tennis shoes! Yes, Jefferson Lab's 15th annual Run-A-Round is set for Thursday, May 4.

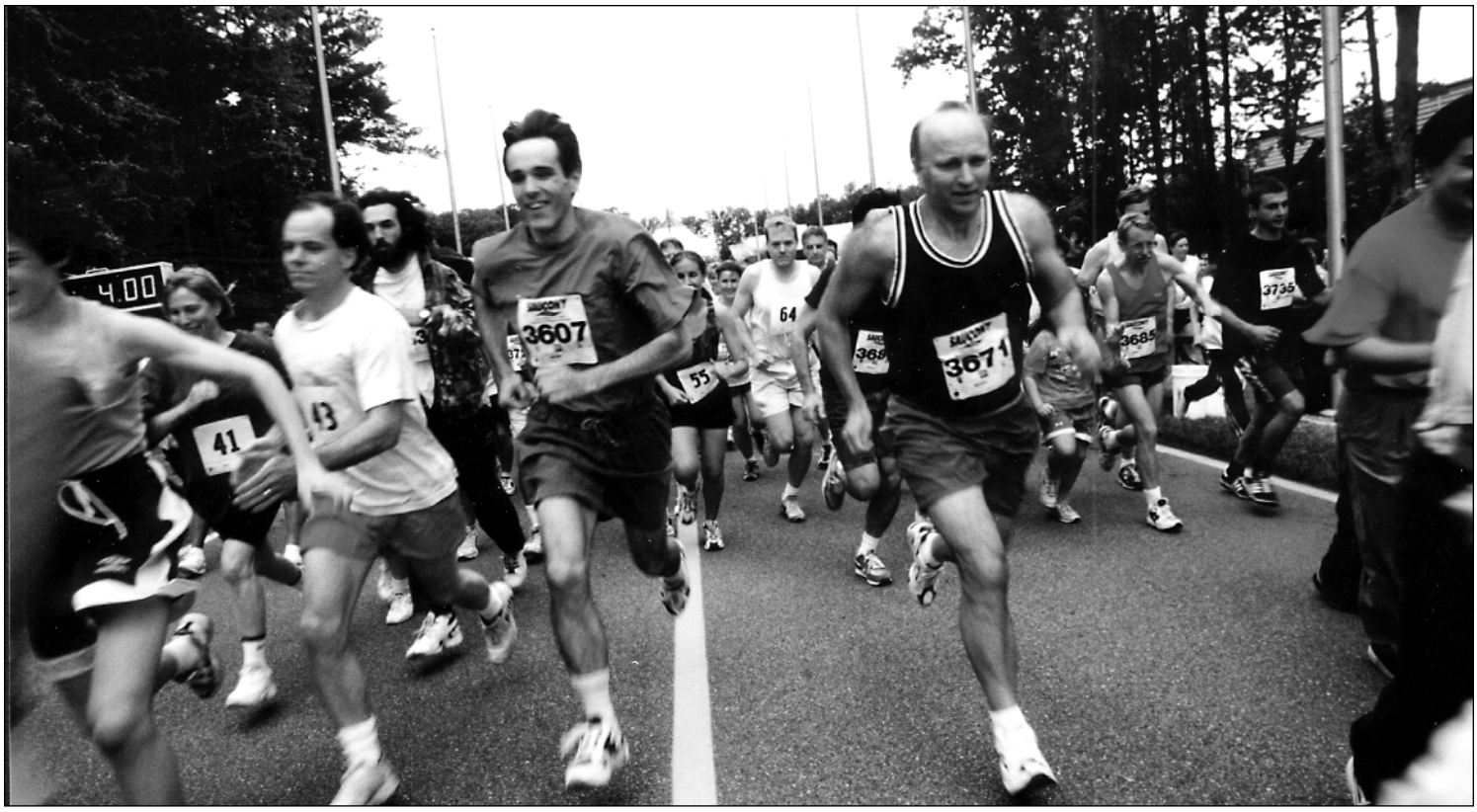
"This is the Lab's annual right of spring," points out JLab Activities Group Chair Susan Esp. "What makes it a success is everyone's participation, and the Run-A-Round offers something for everyone."

The event is open to all Lab employees, their family members, contractor employees and users/collaborators. Registration forms have been distributed across campus and extras are available at the VARC and CEBAF Center reception areas. Completed registration forms should be sent to Dennis Dobbins, MS 28B, by May 1. All registered runners may pick up their race numbers in the CEBAF Center lobby between 9 a.m. and 3 p.m. on race day. Late registration is also available in CEBAF Center on race day, but late registration closes at 2:45 p.m. Specifics about the registration process, race course, age categories and awards are on the registration form.

All registered finishers will receive the 2000 Jefferson Lab T-shirt. More than 230 people voted for their favorite design during the T-shirt design contest held in March, according to Shannan Kyte, User Liaison office. The winning design will be unveiled at 3:15 p.m. The run/walk will kick off at 3:30. Race results will be announced as soon as they have been tabulated. As in past years, the Peninsula Track Club will oversee the run/walk. However, volunteers are needed to help with pre-registration, tracking racers' times, monitoring critical points along the race course, T-shirt distribution, and staffing the water stop at the half-way point and the water and fruit stop at the finish line.

According to Esp, the traditional — and always popular — Golf Cart Parade will take place after all racers have crossed the finish line. Start planning now on the best way to "decorate" your office or department golf cart, she urges. Call Lois Lucas, ext. 7361, to reserve a golf cart. The parade judges have been selected and will be taking bribes the day of the event, Esp says. After golf cart judging, food & drink and entertainment will be available outside the Residence Facility.

Volunteers are also needed to help with food and drink service and with clean-up. Anyone wanting to be a part of the volunteer force may contact Betty Beeler by e-mailing beeler@jlab.org, or calling her at ext. 7491 or Carrie Nichols at ext. 5101.



Last year's Run-A-Round – seconds after the race kicked off.

Milestones
for March 2000

Hello

Kenneth Baggett, Survey Technician, Accelerator Division

Stephen Bueltmann, Hall B Post Doctoral Associate, Physics Division

G. Kirk Davis, Accelerator Engineer, Accelerator Division

Daniel Forehand, Metal Fabricator-Cryogenics, Accelerator Division

William Formichelli, Electrician, Accelerator Division

Christopher Gould, Survey Technician, Accelerator Division

Justine Jackson, Staff Secretary, Accelerator Division

Kim Kindrew, Technical Information Specialist, Administration Division

Kimberly McGinnis, Customer Service Representative, Physics Division

James Murphy, Self Assessment and QA Officer, Director's Office

Kelly Teague, Accelerator Operator, Accelerator Division

Michael Wimbish, Electronics Technician, Physics Division

Gwyn Williams, FEL Basic Research Program Manager, Accelerator Division

Goodbye

Christopher Armstrong, Hall C Post Doctoral Associate, Physics Division

Jun Forest, Theory Post Doctoral Associate, Physics Division

Lionel Gordon, Post Doctoral Associate, Physics Division

Jennifer Moog, Division Administrative Officer, Administration Division

Viet Nguyen-Tuong, Accelerator Physicist, Accelerator Division

Christopher Payne, Operator II, Accelerator Division

Cassin Riggs, Mechanical Design Associate, Physics Division

"Milestones" highlights the achievements of JLab staff and users, full-time and term new hires, separations and retirements. To submit staff or users' promotions, special honors and awards send information to magaldi@jlab.org or call ext. 5102.

Education seeks mentors, projects for interns

Lab Education staff are preparing for the annual High School Summer Honors Internship Program (SHIP) and they need your help, according to Lisa Surles-Law, education specialist.

A dozen high school students will be on site from June 19 – August 11. Education staff members are looking for both mentors and projects for the students. Anyone with a project, or project idea, that would be good for a high-achieving high school student or students, may contact Surles-Law at ext. 5002, or e-mail her at surles@jlab.org. Anyone interested in being a mentor for a student over the summer may also contact the education specialist.

Send Surles-Law a short description of the project and an explanation of what the student(s) would be doing. "We're hoping to attract a range of projects for the group," she says. "In addition to a variety of scientific interests, this year's group has students interested in electronics, engineering, and computer science. A few of the students have well-developed programming skills. If you have an appropriate project, or an idea for one, please get in touch with me by June 1.

Take our Children to Work Day

Registration is underway for the Lab's annual Take Our Children To Work Day.

People wishing to register their children for the event may call the Education Group at ext. 7164, or register electronically on the Web at www.jlab.org/children. The registration deadline is April 24 for the April 27 event. "If you have a son or daughter who would like to attend, please register them by April 24 (no exceptions)," emphasized Jan Tyler, Education Program Manager. "We need an accurate count so we can have adequate volunteer help, snacks and activity materials ready." Last year 76 children (61 daughters and 15 sons) visited the Lab.

The event is open to the children of Lab employees and users (immediate family only), and is geared toward 3rd through 8th graders (8-13 year olds). It will kick off in the VARC Lobby with juice and breakfast snacks at 8 a.m. The youth will participate in science and math activities and go on mentor/work area visits. They will be back at the VARC at noon so they may have lunch and spend the afternoon with parents.

Science Series needs speakers, ideas

Each spring and fall the Education Department schedules a series of science presentations geared toward informing, educating or entertaining the public. Education is currently working on the Fall 2000 and Spring 2001 Science Series schedules, and is seeking input on possible guest lecturers.

The presentations may take the form of demonstrations, lectures, video clips, audience participation activities, or even music and dance shows, according to Jan Tyler, Education Program manager. "The only requirements are that the topic being presented is scientific or science related, and that the presentation is given at a level that is understandable to the general public," Tyler said. "Presenters and topics may come from within the Lab, neighboring science or academic institutions, or special guest speakers from across the country."

If you know of interesting or unique science presentations that could be part of next season's Science Series, contact Tyler by e-mail at tyler@jlab.org or call her at ext. 7164.

Education has been sponsoring the JLab Science Series since 1990. Presentations take place on a mid-week night in the CEBAF Center auditorium and should last approximately one hour.

For a look at past Science Series topics, visit the Education Web page at www.jlab.org/services/pced/?students/teachers/ and select "JLab Science Series Video Library."

bright spot on the web

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Editor's note: If you have or know of a Web Site that could be informative or useful to Jefferson Lab staff, call the public affairs office at ext. 7689 or e-mail Linda Ware (ware@jlab.org).

April 22, 2000, marks the 30th annual Earth Day observance. What started as a national environmental awareness day, initiated by then Wisconsin Senator, Gaylord Nelson, has become an international event. One of the many Earth Day Web pages is the San Diego Earth Times' Earth Day project library located at www.sdearthtimes.com/edn/index.html. The Web site provides information on Earth Day for everyone from long-time Earth Day enthusiasts to someone getting involved for the very first time.

Browse topics including the history of Earth Day and project ideas (everything from steps for getting started, and what individuals and business can do, to 25 ideas anyone can put into action). Or, go to the subscriber's page and signup to receive informative e-mail updates on the environmental issue of interest to you.

ON TARGET

On Target is published by the Thomas Jefferson National Accelerator Facility, a national nuclear physics research laboratory in Newport News, VA, operated by the Southeastern Universities Research Association for the U.S. Department of Energy. News items are published on a space-available basis and are subject to editing. Submit news items to the Jefferson Lab Public Affairs Office, MS12C, 12000 Jefferson Avenue, Newport News, VA 23606.

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