January 2005

ON TARGET

THOMAS JEFFERSON NATIONAL ACCELERATOR FACILITY • A DEPARTMENT OF ENERGY FACILITY

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DOE Site Office staffer,
Barbara Morgan retires

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World Year of Physics

International physics community celebrates centennial of Einstein's 'miracle year'

by Kandice Carter

In Bern, Switzerland, in 1905, a young patent examiner with a Ph.D. in physics wrote five papers that were all accepted and published in *Annalen der Physik*, a respected German physics journal (one of the papers was published in 1906). These papers introduced ideas that transformed the field of physics, providing physicists new avenues of exploration and new ways to pursue them. The young patent examiner was Albert Einstein, and the year was declared Einstein's "miraculous year."

To commemorate his achievements, the international physics community is celebrating the 100th anniversary of Albert Einstein's "miraculous year" with a year-long celebration of Einstein, his ideas and his influence on life in the 21st century. Jefferson Lab is joining this celebration with events and programs open to the public.

The Papers

Einstein's 1905 papers dealt with three topics of particular interest to Jefferson Lab. One provided an explanation for Brownian motion, a phenomenon first described by Robert Brown in 1827 in which plant pollen grains suspended in a liquid remain in constant motion. Another paper described light in terms of individual particles and then used this idea (originally introduced by Max Planck) to explain the photoelectric effect. Two other papers introduced the special theory of relativity and the universally known expression equating mass and energy, $E = mc^2$, subjects that Einstein

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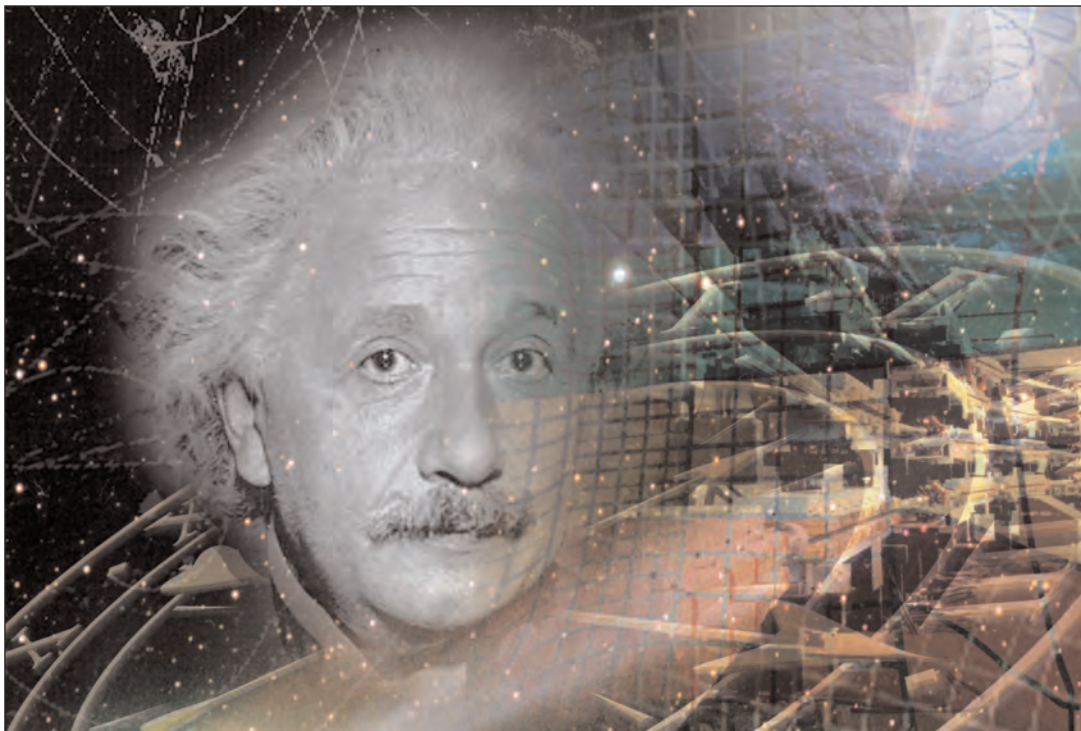

Einstein's radical ideas lead to a better understanding of many topics in physics, including space, time and the structure of matter. His special theory of relativity, for instance, provided a theoretical basis needed for operating Jefferson Lab's own electron accelerator.

Winter-Spring WYOP events

February 8
From Slave to Scientist: A Dramatization of the Life of George Washington Carver
A Science Series Lecture

February 16
Orbiting the Sun with Qubits: An Overview of Science &Technology at the Applied Physics Laboratory
A World Year of Physics Colloquium by Victor McCrary, Johns Hopkins University

March 16
Einstein's Biggest Blunder: A Cosmic Mystery Story
A World Year of Physics Series Lecture by Professor Lawrence Krauss

March 22
A Visit with Marie Curie
A Science Series Lecture

April 16
Jefferson Lab Open House

For more information, visit www.jlab.org/

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would continue to explore in various forms for the rest of his life.

Einstein's paper on Brownian motion not only explained the phenomenon, it also offered an experimental test for the theory of heat and helped to establish the modern view that all matter and material objects are composed of individual atoms and molecules attracted to one another by the fundamental forces of Nature. Scientists at JLab are continuing this work by studying the basic building blocks of individual atoms, with particular interest in how protons and neutrons combine to form an atom's nucleus, or what physicists call the atomic nucleus.

Experiments at Jefferson Lab are carried out with CEBAF, the Continuous Electron Beam Accelerator Facility. The accelerator propels a nearly continuous beam of electrons at an experimental target. These electrons strike individual atomic nuclei in the target, and physicists analyze the reaction to learn about these nuclei, the protons and neutrons inside the nuclei, the quarks inside the protons and neutrons, and the forces holding all these particles together.

Another of Einstein's 1905 papers provided an explanation of the photoelectric effect. It propounded Max Planck's idea that light must sometimes behave like a stream of particles with discrete energies; physicists call these particles photons. This paper, for which Einstein was awarded the 1921 Nobel Prize, was an important step in the development of quantum mechanics, the theory that provides us with the fundamental understanding of molecules, atoms and atomic nuclei. "We didn't know about photons until Einstein's explanation of the photoelectric effect. Einstein really defined the concept of the photon, and we're using photons to investigate the structure of matter. So in that sense, it's really at the very heart of what we're doing," says JLab Chief Scientist and Theory Group Leader Anthony W. (Tony) Thomas.

In experiments at Jefferson Lab, as an electron from the electron beam approaches the nucleus of an atom inside an experimental target, the electron may emit a photon. This photon is what actually strikes the nucleus. And in other experiments, physicists may choose to amplify the number of photons by sending the electron beam into a crystal or some other medium to transform it into a beam of photons with precisely known characteristics. The collisions of photons with an experimental target tell us something about the atoms we're studying.

"You've got a particle coming in, something at rest, and two things going out. In our case, sometimes one of the things going out has been excited, and we learn about its internal structure as well as about its size and shape by doing that," says JLab Physics Division Associate Director Larry Cardman. He says these collisions are a lot like what happens on a pool table as billiard balls collide. To analyze what will happen to colliding balls on a pool table, physicists can use classical mechanics, which use Newton's laws of motion.

But these laws fail to describe the motion of subatomic particles. To describe what happens on that scale, physicists need to use quantum mechanics. "The physical theory we use to describe the systems we're studying, because they are small, is quantum mechanics. But because we're studying them with reactions that involve large amounts of energy and particles moving at very high velocities, the theory we use to describe them is relativistic quantum mechanics, which merges Heisenberg and all of quantum mechanics with Einstein's theory of relativity," Cardman adds, "If you're looking at the reactions we do at the energies we do them, you can't do it without invoking and using, every day, the special theory of relativity."

The Special Theory of Relativity

The special theory of relativity is arguably Einstein's most renowned contribution to the field of physics. Einstein introduced the concept in two papers that addressed a central puzzle for physicists of the day, the connection between electromagnetic theory and ordinary motion. Most importantly

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From the Director

Christoph Leemann
Jefferson Lab Director

Significant events of 2004 drive the opportunities, challenges we face in 2005

Dear Colleagues:

As we begin 2005, I would like to reflect on some of the significant events during the past year at Jefferson Lab that have set the stage for the challenges and opportunities we face in the coming year.

Early in 2004, Anthony W. (Tony) Thomas joined us and assumed the role of Chief Scientist and head of the Theory Group. With Tony's enthusiasm and strong leadership, he is building on our scientific program and is becoming an important part of the team shaping the scientific future of Jefferson Lab. He has also become a catalyst in furthering development of the Excited Baryon Analysis Center.

A sustained and focused effort by accelerator operations staff improved machine running time and reliability after Hurricane Isabel hit in September 2003. A well-planned recovery and new maintenance program have resulted in better, more reliable accelerator operations. New procedures to bring the machine up delivers beam to the halls in a more timely and efficient manner. Upgrades to the injector system and the CEBAF control room enhanced our ability to carry out the Lab's world-class scientific research program, which achieved a noteworthy milestone when data collection was completed on the 100th experiment run at Jefferson Lab — in less than nine years of operation. By year's end the total number of experiments completed reached 110 with another 12 partially done. In the last quarter of 2004, Accelerator and Physics Division staff were able to push the productivity of the halls to deliver more science. This increased science output is a testament to skilled and dedicated staff working together in the accelerator and end stations.

The critical first major milestone in upgrading the Continuous Electron Beam Accelerator Facility from a 6 GeV (billion electron volt) to a 12 GeV machine was achieved on April 19, when then Deputy Secretary of Energy Kyle McSlarrow announced the Department of Energy's approval of Critical Decision Zero, establishing the "mission need" for the Upgrade. Assistant Director Allison Lung as Project Director has made significant progress on the 12 GeV Upgrade Conceptual Design Report due to DOE this year; and we anticipate approval of the preliminary baseline work plan (CD-1), later this year.

Other highlights from 2004 include the beginning of construction on the CEBAF Center addition, which is expected to reach completion at the end of 2005 and the delivery of 10 kW of infrared laser light from the Lab's Free Electron Laser in July. The FEL also added an Army-funded terahertz beamline capable of generating 100 Watts of terahertz light for scientific studies, nearly 100,000 times brighter than available anywhere else in the world.

The Department of Energy's Science and Technology and Institutional Management Reviews of Jefferson Lab declared the Lab's scientific program "truly outstanding" and yielded kudos for our 12 GeV Upgrade project, SRF capabilities, Free-Electron Laser and our work for the Spallation Neutron Source. This outstanding record is a testament to the hard work, inventiveness and focus of our team, and it underscores the importance of developing a strong program to carry the Lab into the future. However, a Lab-wide trend of increased safety incidents which led to JLab ranking near the bottom of Office of Science facilities in safety performance was a cause for DOE and Lab concern. JLab was ranked ninth out of 10 with our total recordable case (TRC) rate and seventh out of 10 with our days away, restricted, or transferred (DART) rate. To address this trend, I implemented a number of actions including the formation of committees to review our policies and procedures for personal protective equipment, materials handling, and electrical work, engagement of a con-

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DVCS@JLab

'Interference' used to study inner structure of protons, neutrons

by Kandice Carter

When you throw two rocks into a pond of water, side-by-side, the ripples created by the rocks will collide and annihilate each other in some areas and combine to make bigger ripples in others. Physicists call this phenomenon interference. In a large Hall A experiment that completed taking data in early December, physicists are using this same phenomenon to get them one step closer to a three-dimensional picture of the inner structure of protons and neutrons in the nucleus of the atom.

The experiment, called DVCS@JLab, ran in two, back-to-back parts from Sept. 18 through Dec. 5. DVCS, or "deeply virtual Compton scattering," is the process these experiments used to learn about protons and neutrons (nucleons).

In this process, physicists use the CEBAF accelerator to propel a beam of electrons into an experimental target. When these electrons strike the target, many collide with the nucleons in the nuclei of atoms. In the first part of the experimental run, the researchers were interested in those collisions where an electron has struck a quark inside the proton, giving the quark extra energy and knocking it out of the proton. This quark then gets rid of the excess energy by emitting a photon, or a unit of light, and is reabsorbed by the proton. In the second part of the experiment, the researchers looked at the same process in the neutron.

For the experiment to work, the scientists needed to be able to measure the speed, position and energy of the electron that had bounced off the quark, the photon given off by the quark, and the re-assembled proton. The researchers used Hall A's High Resolution Electron Spectrometer to measure the electron and a scintillator array they built to measure the proton.

According to Pierre Bertin, Director of Research at the Laboratoire de Physique Corpusculaire de Clermont-Ferrand and lead spokesperson for DVCS@JLab, the most important piece of equipment in the experiment is the new calorimeter the researchers constructed to measure the photon. "We have built a calorimeter, a very nice one. And it is the heart of the experiment, because we need to know perfectly the energy of the photon. And at this time, we can measure that to within two or three percent. That is the accuracy of our detector, and it is very necessary because that will allow us to go a factor of 10 better than experiments have done before," he says.

A Calorimeter with No Name

The total cost of the calorimeter is about $750,000. The calorimeter and the scintillator both spent four months in the Test Lab undergoing final checkout procedures before installation in Hall A began in July 2004. Franck Sabatie, a researcher from CEA-Saclay and a spokesperson on the experiment, says the calorimeter is composed of an array of lead-fluorite crystals. "The lead-fluorite crystals look like glass, but they're very dense — as heavy as iron, basically."

"We have 132 block crystals, so it's not too big," Bertin says. Each rectangular crystal rod measures 3 by

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DVCS@JLab is a Hall A collaboration experiment, with more than 40 researchers from 13 institutions, including LPC Clermont-Ferrand, CEA Saclay, LPSC Grenoble, Old Dominion University (ODU) and Rutgers University. The experiment has five spokespersons: Pierre Bertin, Charles Hyde-Wright, Ron Ransome, Franck Sabatie and Eric Voutier. Hyde-Wright oversaw construction of the proton scintillator array (pictured) at ODU.

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3 centimeters on end and nearly 20 centimeters in length. Attached to the end of each crystal is a photomultiplier tube.

"And what happens is — the photon — as soon as it enters a very heavy material, creates an electron and positron, and these then radiate more photons," Sabatie explains, "The new photons then create more electrons and positrons... so there's a shower of particles inside the crystal." The result is a flash of light inside the crystal, which is measured by the photomultiplier tube and recorded. "That allows us to reconstruct both the energy and the position of where the original photon hit the calorimeters," Sabatie adds.

As for what the scientists call the calorimeter, Bertin notes, "It doesn't have a name." According to Sabatie, some of the collaborators have taken to calling the calorimeter Calo, because it's a small one as far as calorimeters are concerned.

Installing the equipment into Hall A for the experiment took about two months. "It's one of those experiments where we added several detectors to the main hall instrumentation. And that meant a lot of installation time. So we started in July, and we finished basically when beam arrived on Sept. 18," Sabatie says.

Back to Interference

Bertin says that even with the new dedicated calorimeter, proton scintillator and other equipment, the analysis of the data from the experiment is going to be challenging. That's because the detectors will record information from more than one process that will result in the telltale photon recorded in the calorimeter. "We have two processes in competition. We have the Bethe-Heitler process, where the photon we detect in the calorimeter is simply emitted by an electron. That is one process, then," Bertin explains, "in DVCS, the photon going in the spectrometer is emitted by the proton. But there will be fewer photons produced in this process, and this is the one we're interested in."

The signal the physicists will record in the experiment will contain events from both processes: DVCS as well as the Bethe-Heitler process. It turns out that theory projects these processes will overlap, or interfere, in a predictable way, inflating the photon signal that the detector records in some areas and reducing the signal in others. The physicists aim to separate out these processes by using what they know about how these processes interfere.

The Bethe-Heitler is a well-known process that can be calculated from theory. "We get DVCS just by taking out what we know from the Bethe-Heitler theory," Sabatie explains. Bertin adds, "And that is the new thing in this physics. This trick will allow us to get the result we're looking for." The researchers have begun analyzing the data and expect to obtain results sometime in the next year.

Generalized Parton Distributions

The goal of the experiment is to test the theory of generalized parton distributions (GPDs). GPDs are a set of mathematical functions that may allow physicists to produce a three-dimensional snapshot of the inner structure and dynamics of protons and neutrons in the nucleus. Physicists can use these functions to map out the location and momentum of the quarks and gluons inside protons and neutrons. "This is the first experiment dedicated to GPDs," Bertin notes.

This experiment won't provide enough information to put together a map of the internal structure of protons and neutrons just yet. Rather, it will provide enough information for a calculation of one aspect of the structure of the nucleon. "We are measuring one point. So the experiment won't give us the whole picture of the nucleon, but it will give us one accurate measurement that relates to the structure of the nucleon. It will allow us to check the theory," Sabatie explains.

He says if the experiment is successful, it will pave the way for broader experiments. "We will need a lot of pictures to reconstruct a 3-D image of the nucleon. So the next step is to plan a much bigger experiment, and this is basically what Jefferson Lab is doing with the 12 GeV Upgrade," he says.

A brief explanation of deeply virtual Compton scattering

Deeply Virtual Compton Scattering (DVCS) gets its name from the process that describes how the electron interacts with the quark. Electrons interact with other particles through the electromagnetic force. The carrier of this force is the photon (also known as the particle of light, photons carry the electromagnetic force in all its wavelengths — from gamma rays to visible light to radio waves). So, an electron will never strike another particle directly; instead, it's thought to emit a photon that interacts with another particle.

No one has ever seen or detected these photons directly, so they're referred to as "virtual." Virtual photons are thought to be very different from actual photons. For instance, they may have mass. The "deeply virtual" in DVCS refers to virtual photons that have a lot of energy to transfer to other particles. "Compton scattering" describes this transfer of energy between particles in terms of electrons and, in this case, virtual photons.

In step with Occupational Health & Safety

Staff promotes health; prevents illness, injury in the workplace

From left are Johnie Banks, administrative assistant; Heather Singleton; Melissa Holloway, occupational health nurse and Dr. "Smitty" Chandler, Occupational Health and Safety medical director. Heather Singleton, OHS nurse manager, departed JLab on Jan. 19 for an executive nursing position at Eastern State Hospital.

The day-to-day activities of Jefferson Lab's Occupational Health and Safety group (formerly "Medical Services") vary widely, but everything its staff members do reflect their commitment to the health and well being of employees.

OHS provides occupational health and safety services to Jefferson Lab employees. The group focuses on promoting health and preventing illness and injury in the work place while educating and helping to protect employees from work related hazards.

"We're a full service occupational health program," says Dr. W. Smith "Smitty" Chandler, who has been the Lab's medical director since 1988. He is Board Certified in Occupational Medicine and helps oversee the occupational health and safety of about 25,000 people working for various organizations throughout Hampton Roads. The OHS group also includes Melissa Holloway, occupational health nurse and Johnie Banks, administrative assistant, who oversee the day-to-day medical needs of Lab employees.

"All new employees receive a medical evaluation from OHS to help assure that they are able to perform their work safely," Dr. Chandler explains. In addition to performing these assessments, OHS conducts ongoing medical monitoring for JLab staff members with specialized job requirements. Examples include employees working in environments where they may be exposed to radiation, oxygen deficiency or high noise, and employees who operate cranes, lifts or platforms, or work with lasers.

A critical aspect of occupational health is evaluating job-related illnesses and injuries. Anyone at JLab who becomes acutely ill or is injured while at work must contact OHS immediately. OHS staff members provide first aid and help the injured person find appropriate off-site care, when it is necessary. They'll follow up too, making sure that the employee's care is meeting his or her medical and psychological needs. "It is important that anyone with a work-related injury or illness contact us immediately," Chandler emphasizes. "Timely reporting of injuries, and prompt medical care can often help to keep problems from becoming more severe."

"JLab experienced 15 recordable injuries during fiscal year 2004, and that's a number we must all work to bring down," Dr. Chandler adds. "But what is even more distressing is that six of these recordable injuries weren't immediately reported to the injured individual's supervisor and the Occupational Health and Safety team. Several of these incidents would have required only basic first-aid from a medical professional if promptly treated. And first-aid cases don't count as recordable injuries. Safety records are important, but even more important is the fact that prompt evaluation reduces the chance that people will suffer unnecessarily. " (Injuries determined to be recordable under Occupational Safety and Health Administration guidelines are Department of Energy reportable.)

As part of the Lab's Human Resources Department, "our primary job is to help and support employees," Dr. Chandler notes. To that end, the

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For more information about OHS visit the web at www.jlab.org/div_dept/admin/medical/

or stop by the OHS office in the VARC (building 28, room 22C)

phone number: ext. 7539
JLab emergency response: ext. 4444

How to successfully tackle those New Year's resolutions

Dr. Chandler suggests tactics for making healthy lifestyle changes

by Judi Tull

So you've made those New Year's resolutions: you're going to eat better and less, exercise more, and give up those bad habits. Dr. W. Smith "Smitty" Chandler, Jefferson Lab's Occupational Health and Safety medical director, has a message for you: slow down.

"The most common cause of failure in positive lifestyle change is trying to go too fast," he said. "People get impassioned, then they get frustrated if they don't see immediate improvement. It takes decades to become a certain way, and therefore it takes time to make improvements that last."

And the power to make those changes is all yours. Smoking, Dr. Chandler explained, is the single worst thing you can do when it comes to your health. Its effects are far reaching and its addictive qualities powerful, in part because inhaling is the second fastest method of drug delivery to the body. That makes smoking extremely "reinforcing." The key to quitting, he said, is to keep at it, and maintain a fighting attitude. "The people who ultimately fail at smoking cessation are the ones who, having tried once or twice to quit and were unsuccessful, give up and take the attitude of 'I'll take my chances,'" he said. "The ones who succeed are those who keep trying over and over until they succeed."

Regarding nutrition, Dr. Chandler suggested that, overall, sugar and sweets are the most unhealthful foods, followed by starches and fat from red meat. He also recommends against snacking between meals. "In theory, snacking is consistent with our heritage because most of our genetic makeup comes to us from populations that grazed on things like berries and insects. But in today's world, it is the norm to 'graze' on snacks that are high in sugar and fat."

Cut out the snacking and you'll do yourself a world of good. Getting up from the table sooner is a good first step toward healthy weight loss. "Many people need more structure in their diet," Dr. Chandler said. "At meals, eat until you're full, but not stuffed. Slow down and give your body the chance to tell you it is full."

In the long run, he pointed out, overeating — and eating sweets and starches — leads to more hunger and, in a vicious cycle, more overeating. "In the long run, eating more causes more hunger. Eating less causes less hunger."

Like smoking, being overweight can have far-reaching consequences. Overweight people tend to exercise less; they are more vulnerable to developing numerous diseases such as heart attack, cancer and adult-onset diabetes. Longevity, the doctor said, is strongly influenced by waist size. "But don't try to change too much too fast," he advised, "because, in the long run you will fail. Make one small improvement per month every month. Each improvement makes the next a little easier. These improvements add up. You will feel better and live longer. If improvement is torture, you're going too fast. Go, but go slow. Make the journey a reward, not a punishment." So start small. Spend a year declaring war on sweets. At the end of it, you won't even like sweets anymore. Spend the next year minimizing starches (white bread, white rice, white potatoes and white pasta). Next reduce animal fats, and so on. The more improvements you make, the more you can make and the more you'll want to make."

The single most critical key to well being, Smitty added, is exercise. He participates in — and recommends for others — "high-dose" exercise that burns a minimum of 2,000 calories a week. That equates to walking or running approximately 20 miles a week, or doing some other vigorous activity. "High-dose exercise is the closest thing we have to a fountain of youth," he noted.

"Many of the phenomena that we attribute to aging are actually only weakly associated with the passage of time, per se. Instead, they are more strongly associated with steadily reduced physical activity over the years. Regular exercise buffers us from the reduced quality of life that comes with 'age.' Regular, intense exercise decreases intellectual decline, cardiovascular death and disability, cancer, and much more. Overall, exercise saves you time because you live two

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Occupational H&S...

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group has an active ergonomics consultation service. Sometimes employees request OHS assistance if, for instance, they do a lot of keyboarding and notice discomfort in their hands or wrists. At other times, group leaders request that Chandler come to their work areas to make sure that all employees are performing their jobs in the safest manner possible. OHS staff members also work closely with the Lab's safety and industrial hygiene professionals on numerous issues such as electrical and chemical safety.

Chandler's medical philosophy centers on prevention of disease and injury. "I strongly agree with the traditional Chinese attitude that it is good to cure disease, but it is far better to prevent it," he notes. He and his staff often counsel employees on what he calls "lifestyle therapy," topics including nutrition, exercise, and preventive testing such as colonoscopy and mammography. To that end, OHS provides employee wellness services such as weekly blood pressure monitoring, every Thursday from 2-4 p.m. The group conducts periodic seminars and can provide information on a range of medical and occupational health topics.

On average, the staff takes care of about 15 to 20 people per day, sometimes in person, and sometimes over the phone. Duties are divided up among them, and Melissa Holloway conducts CPR/AED (cardiopulmonary resuscitation/automated external defibrillator) training.

"We are in a state of constant evolution," Chandler notes. "We're always looking for new ways to support employees; and we'll continue to add services and search for new ways to help employees."

Healthy lifestyle choices...

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minutes longer for every minute that you exercise. It also makes people more productive and energetic."

"It isn't always easy to find time to exercise. But, here again, evolution beats revolution. It takes time to adjust your habit system to incorporate exercise. For instance, you have to decide what to give up," he said, "and TV is the right place to start." One reason that exercise is so important in weight control is that exercise raises your metabolism so that eventually, even when you're not in motion, your internal motor is running at a faster speed.

One thing you don't want to give up in order to exercise, however, is sleep, another key component to an overall healthy lifestyle. You owe your brain seven to eight hours of sleep a night and you should do everything possible to get it, Dr. Chandler emphasized. Give up that late-night TV program and hit the sack. If you're waking out of a deep sleep to the screech of the alarm clock, you're not getting the sleep you need. Chronic sleep deprivation can lead to a variety of health problems including cardiovascular disease. It also reduces alertness, a key element needed, especially at the Lab, for safety and productivity.

The essential element of successful lifestyle change is to think of each small step as laying down the base of a pyramid of health. As you make each small change for the better, you'll feel better about it. And soon you'll feel better about doing good things for yourself instead of hanging on to those old, bad habits. And that, Smitty said, is the key to keeping at it. "Evolution beats revolution. You're not sentencing yourself to a life of deprivation," he said. "People with healthful lifestyles have lots of fun."

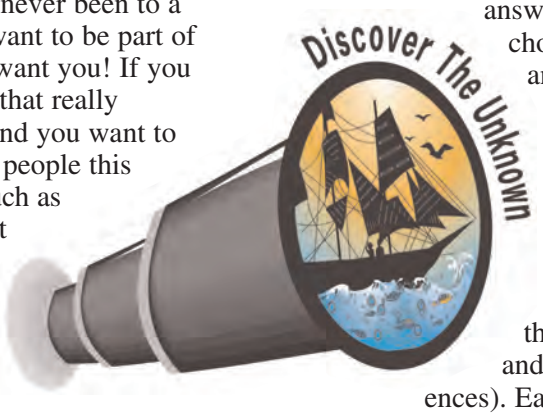
The Lab's Occupational Health & Safety staff offers on-going wellness support including individualized counseling and advice with Dr. Chandler, and blood pressure and cholesterol monitoring. The OHS team encourages the JLab community to get started on preventing disease before it begins.

Science Bowl 2005

JLab needs dozens of volunteers to conduct academic event

It's almost Science Bowl time, according to Jan Tyler, JLab's Science Education manager. Like last year, the Lab will be hosting two Science Bowls in the coming months: the Virginia Regional High School Science Bowl on Saturday, February 12, and the Virginia Regional Middle School Science Bowl on Saturday, March 5.

The call for volunteers to help with one or both of these events is going out to JLab employees, users, family members and students, according to Tyler. "Your co-workers, spouses and children (over age 13) may volunteer, too. There are plenty of duties to go around," Tyler adds. "So if you've enjoyed helping out with prior Science Bowls, or if you've never been to a Science Bowl, but want to be part of the excitement, we want you! If you were part of a team that really 'clicked' last year, and you want to work with the same people this year, we'll do as much as possible to make that happen."



"The Science Bowl is an annual, highly visible educational event and academic competition among teams of students," Tyler explains. "These events champion an interest in science and math across the nation. This year we have 24 teams signed up to compete in the Feb. 12 high school event. Returning, will be the reigning Virginia regional and national champions for the last three years, the Thomas Jefferson High School for Science and Technology, from Alexandria, Va. However, they'll have new competition this year with Hampton Roads Academy (Newport News) joining the tournament."

More than 70 volunteers will be needed to run the daylong competition. On that day, CEBAF Center and the VARC will be taken over by more than 200 high school students, their coaches, and the dozens of volunteers needed to conduct the tournament. The morning consists of a round-robin competition, followed by double-elimination rounds in the afternoon.

"By 5 p.m. we'll be ready to name the winner," Tyler says. The top three teams earn cash prizes for their respective schools, and the top team wins a trip to the Science Bowl Nationals held in Washington, D.C., April 28 – May 2.

"We're excited to host these events. They are a great way to promote education, academic excellence and an interest in math and science," Tyler points out. "Competing with their peers is a great confidence builder and a fantastic way to motivate young minds."

The Science Bowl, celebrating its 15th year of Department of Energy sponsorship, is an academic competition among teams of students who answer multiple-choice and short-answer questions on a variety of scientific topics (chemistry, biology, physics, mathematics, astronomy, and the general, earth and computer sciences). Each team is made up of five students, and a teacher who serves as advisor and coach.

Most of the volunteers are needed to perform as competition moderators, rules judges, timekeepers and scorekeepers during the morning, round-robin sessions, according to Tyler. She also needs a small number of volunteers as the on-site scientific team that is called when a student challenges a question or answer during the competition, and a few individuals to help with administrative tasks and to assist with the alternative afternoon activities planned for the teams that fall out of the competition during the morning session.

The moderators, rules judges, timekeepers and scorekeepers each have specific roles during the competition. Detailed descriptions of each position's responsibilities have been posted on the Science Education web page at http://education.jlab.org/sciencebowl/.

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"Discover the Unknown with Science"

Science Bowl
Volunteer Training Sessions

Thursday, Feb. 3
1:30 p.m.

Friday, Feb. 4
10:30 a.m.

Practice Sessions
Thursday, Feb. 10, 3 p.m.
Friday, Feb. 11, 9 a.m.

All training sessions will be held in the VARC, building 28, classrooms 72 A and B.

In their own words

with Electronic Media's Jessica Ledbetter

as told to Judi Tull

I'm a Newport News native, but I moved around a lot with my family. We lived in North Carolina, Texas and California before returning to Virginia. I went to Longwood College with every intention of becoming an English teacher. I love language, and the rules of grammar are fascinating.

Everything changed for me when I had the opportunity to do an internship at NASA. I was hired to do technical writing but started helping out the Systems Administrator. He noticed my aptitude for working with computers and suggested I consider majoring in computer science. When I went back to Longwood College, I switched to a double major, found that grammar and syntax are not all that different, and, although I had a scholarship, finances were very tight. So I came home to re-evaluate what I was going to do. I got a full-time job as secretary at Christopher Newport University and started to take classes at night with the intention of finishing my degree in Computer Science. My supervisors were amazingly supportive of my full-time class load. I'm still thankful for being so lucky to have worked with them.

I dove into campus life at CNU. I was in the Alpha Phi sorority, and started the CNU chapter of the international Computer Sciences Honor Society, Upsilon Pi Epsilon, or UPE. I held several offices in the Association for Computing Machinery (ACM) club on campus, and was managing editor of ACM International's student magazine *Crossroads*. While on the staff of *Crossroads*, I did a few cartoons that still get me the occasional appreciative email.

Since I love English and artistic things, I became editor-in-chief of *Currents*, the University's literary magazine, and worked on the school newspaper as its webmaster. I was also vice president of the Leadership Honor Society, Omicron Delta Kappa, and a member of Sigma Tau Delta, the English honor society.

By the time graduation was approaching in the spring of 2001, I had a job offer in Washington, D.C., doing Java programming. It would have paid well, and I love programming, but I knew that I wanted my career to have some artistic facet to it as well. So I took a leap of faith and turned that job down, believing in my heart that I would find the more perfect job closer to home.

I knew about Jefferson Lab because a lot of the physics and computer professors at CNU have ties here and everything I had heard was wonderful. It sounded like an interesting, stimulating, yet casual environment, and it has certainly proved to be all that and more.

I was looking at the Lab's website one day and there were two jobs in computers open, one of them as a web developer. So, with encouragement from my CNU professors, I applied for it. The process took a while, but the day before graduation I was offered the job. I was one of the lucky few graduating with a degree in computer science that had my dream job before officially graduating.

I made a lot of sacrifices to achieve this goal, and I have my mom, grandmother and aunt to thank. They are truly my role models. My mom, Cindy Crawford, has taught me to go for my dreams and that things work out in the end. And speaking of my mom — a few months ago she called and asked me what I'd think of her working here too. I thought it was terrific. Now she works in the residence facility, and we're able to have lunch together every now and then.

I'm part of the Electronic Media group. We're officially part of the Physics Division, but we have customers all across the Lab. The core of what I do is web development, but I also do images for the front page, some posters, and feed my baby — the JLab Insider (intranet page). In case you haven't noticed, it's pretty customizable. I had a lot of fun programming it, and hope to add more features. I've also been working on a new web template. This redesign is more web standards compliant, accessible and, hopefully, easier to use.

I gave my first professional presentation in front of peers at the end of October at InterLab, held in Oak Ridge, Tenn. InterLab is a yearly conference for webmasters, developers, designers, and the like from the Department of Energy labs. It's a

Continued on next page

Barbara Morgan, DOE Site Office staffer, retires

Long-time Department of Energy Site Office staffer Barbara Morgan retired Dec. 31. The Environmental, Safety, Health and Security Manager joined the DOE Site Office in February 1990 to oversee safety during construction of the accelerator and the three end stations or experimental halls. She came to JLab from the Norfolk District Army Corps of Engineers with experience as a construction inspector.

"The [accelerator] tunnel was about one-third completed when I arrived," Morgan recalls. "It has been incredible to see a project like this develop from scratch. It's been awesome to watch — almost from the very start, through to completion, and now operating and producing cutting-edge science. I've had a unique perspective."

With a couple seashell fossils retrieved from the tunnel excavation site sitting on her window sill, Morgan reflects back over the years: watching the hall domes being wrapped in water-proofing materials before being capped with earth, working with JLab staff on the Work Smart Standards requirements, following state and federal environmental permitting processes as the Continuous Electron Beam Accelerator Facility prepared to become operational, and verifying and validating JLab's Integrated Safety Management (ISM) program. She witnessed many significant Lab events including the CEBAF Dedication in May 1996 and visits by various Secretaries of Energy and other dignitaries over the years.

However, she says, "It is the people here that I'll miss — a lot of hard-working, good people that I admire. While we (DOE and JLab) may not always agree, we've always worked to understand where the other one is coming from. And for the most part, it's been a win-win situation."

Initially Morgan's accelerator construction-site safety job was a good fit with her extensive Corps of Engineers experience. "The Lab was even using the Corps of Engineers handbook as a guide on the building project," she recollects. Later on, being able to review the development of the Lab's ES&H program — fire protection, radiological control, waste and materials handling, environmental permitting and emergency management — to ensure that JLab was complying with all federal, state and local ES&H requirements added new challenges to Morgan's role. Attending college at night, she completed a Bachelor's Degree in Safety Management and a Master's Degree in Industrial Hygiene, and became a Certified Safety Professional and a Certified Hazardous Material Manager. Over the last several years, ensuring that appropriate security requirements to protect people and property at JLab are addressed has become an equally demanding function of her job.

Retirement plans include Morgan and husband, Ricky, selling their house in Suffolk and buying a one-story home in the same general area, and traveling. "I'm looking forward to the change and whatever the future may bring," Morgan adds, which will include coming back to JLab early in 2005 for a time to assist in preparing the required environmental documentation for the 12 GeV Upgrade.

In their own words...

Continued from previous page

great chance to learn technologies, gather solutions and network.

I'm taking classes now in graphic design at Thomas Nelson Community College; I've also taken drawing classes at the Peninsula Fine Arts Center. I'm headed for an Associate's Degree in computer arts, and then hope to go on for my Master's at Virginia Tech or The College of William and Mary. I really believe that everything is connected; arts and science are not separate. I hope my Master's will include both. If not, I can finish up my English degree and tack on some more art classes. Maybe I will also get a Bachelor's in art.

I want a Ph.D. someday but I'm not sure what the subject will be. Maybe by then I will have found a program that combines computer science, art and English.

Lawrence Ferbee, Jr., Stockroom clerk, surrounded by some of the Odds & Ends items and materials available for JLab work.

Before placing an order...

Checkout Stockroom's Odds & Ends area

Before you order supplies for that small JLab job, or to finish a larger project you've run short of supplies for, visit the JLab Stockroom's Odds & Ends area. Odds & Ends Stock carries wiring, cabling, switches (resistors, connectors and other electronic items), fasteners (nuts, bolts and washers), and some general office supplies. These items are leftover materials or supplies that have already been purchased.

These materials and supplies may be used for JLab work being conducted anywhere on campus, at no cost to the person or workcenter wishing to use them. With more than 500 items currently in O&E Stock, what you need just might be there — waiting to be picked up and used — for free, says Lawrence Ferbee, Jr., Stockroom clerk.

Anyone can submit usable or reusable, excess or leftover materials to O&E Stock. Say you've just finished a job, moved your office, or cleaned out a cabinet and have usable quantities of materials or supplies you have no further use for — not just trash, but stuff others can use — give them to O&E Stock, Ferbee says. "It's a great way to use up leftover materials and supplies that the Lab has already paid for," he adds. "After all, one person's junk can be another's treasure."

Ferbee oversees JLab's O&E Stock, which began as one cabinet in 1997 at the request of Bill Brisiel, Stockroom manager. Over the years the area has grown and now fills a full aisle in the Stockroom. Individuals with purchase accounts may peruse the electronic list of O&E Stock items, visit http://esac.jlab.org/stock.html and sign on to the webstock page. At the top of the page is a highlighted link: *New! Request FREE Stockroom items*. Click on this and open the electronic list. O&E Stock can also be accessed via db3 on the Lab's computer system.

JLab employees and users with or without purchase accounts may also stop by the Stockroom in building 90, any time during normal business hours to examine O&E Stock materials and supplies. There are restrictions with O&E Stock items; for instance, individuals needing them must sign them out and take them from the O&E Stock area. These items can't be delivered through the Lab's on-site distribution and delivery system.

Anyone with questions about posting something to, or getting something from O&E Stock, may contact Ferbee, ext. 6297, or email ferbee@jlab.org. There are some items, such as unused toner cartridges that Ferbee won't allow in O&E Stock, as they don't age well, and if the printer or copier model that used a type of cartridge is no longer on campus, the toner cartridges will never be used. "Then it's best to just put the cartridge into recycling, Ferbee noted.

Science Bowl...

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All participants and volunteers will receive a "Discover the Unknown with Science" T-shirt. Volunteer shifts will run from 8:30 a.m.-1 p.m. and from 1:30-5 p.m. with more people needed for the morning shift.

"This is strictly a volunteer activity," Tyler reminds aspiring helpers. Anyone interested in more information or in volunteering for the Feb. 12 event my contact Tyler, email Tylerjlab.org or call ext. 7164.

Currently, 16 teams are registered for the Middle School Science Bowl slated for March 5. "This means we anticipate needing 45 volunteers to support the second Science Bowl event," Tyler says. More information about the Science Bowl in March will be forthcoming.

In Memoriam

JLab mourns death of Sylvia Smith

Sylvia G. Smith, long-time JLab employee, died Nov. 12, 2004, at home after a courageous battle with cancer. With 19 years at JLab, she retired on Jan. 31, 2004, as an accounts payable clerk assigned to the Chief Financial Officer's department.

Dozens of friends and co-workers visited with her son, granddaughter and other relatives after a funeral service held at Peninsula Funeral Home on Nov. 15. She was buried Nov. 18 at Oaklawn Memorial Cemetery in Winston-Salem, N.C. A native of Kernersville, N.C., she had been a Peninsula resident for 33 years. The family thanked all of Sylvia's friends who had tirelessly given of their time to assist her during her illness.

She was among the first group of employees to reach 15 years of employment at the Lab. Asked after the November 1999 service awards ceremony, what she enjoyed most about working at the Lab, she had exuberantly responded, "The best part of my job is interacting with different people. I'm not stuck behind the computer all the time. My job has so many good points."

Dozens of JLab employees gathered in the VARC on Feb. 17, 2004, to celebrate the career and contributions of Smith upon her retirement. Several years prior, she had been beset with cancer that she fought with incredible spunk. She was in remission at that point and had decided that in the best interest of her co-workers she would retire. During her reception, senior Lab leadership, friends, supervisors and co-workers past and present honored her many accomplishments and years of commitment and hard work at the Lab. They also shared the many special qualities and characteristics that made Sylvia Smith the indomitable woman she was. On the lighter side, they commented on her love of impossibly high-heeled shoes, and her move to sensible shoes when she joined Finance. They smiled over the recognizable sashay of her walk as she went down the hall, her sarcastic "love" of Blue Sheets (an accounting form), her rubber stamp, the Redskins football team, and her readiness to volunteer at any JLab event.

"Her hard work helped to put JLab on the map," noted former supervisor Julie Leverenz, Business Services, "and she left her mark on JLab in ever so many ways, including her initials in the concrete under CEBAF Center Wing A. She is very much loved and will be missed along with her feistiness."

From the Director...

Continued from page 3

sulting firm to conduct a detailed Work Management Review and formation of a Laboratory Safety Director position and a Director's Safety Council. Using these resources, we have begun the process of integrating improvement suggestions from the review activities and creating a comprehensive JLab Safety Improvement Plan. During a January meeting with our DOE Program Director Dennis Kovar, he commended the Lab's recent safety improvements: We worked through the last quarter of calendar year 2004 with no reportable or lost workday mishaps. Most recently, I sent Lab-wide a Safety Culture Assessment Survey, and I hope everyone on campus takes the time to complete the questionnaire by the Feb. 4 deadline. I thank each of you for your increased attention to safety, and your continued vigilance. With that we can continue to make the strides necessary to sustain excellent safety performance.

Looking to the year ahead, our experimental program is strong and dynamic, the accelerator hardware is solid, and we are positioned to efficiently carry out our first-in-class scientific research program. We've done much to improve safety across the Lab, but we must work continually to enhance our safety culture to avoid negatively impacting the valuable science we have to accomplish. Each of these elements are critical to the Lab's continued vitality and success, and I applaud your progress and ask for your continued attention to the intellectual and scientific quality, operational efficiency and safe conduct essential to our scientific mission.

Youngsters flooded the CEBAF Center lobby on Dec. 11 for the Jefferson Lab Children's Holiday Party. The JLab Activities Group sponsored event included a chance to talk with Santa Claus, and a variety of games, arts & crafts and refreshments. Each family brought a snack to share and a new toy for the Toys for Tots drive. Test Lab employees contributed a dozen bikes and helmets to the toy drive. Local Toys for Tots representatives (a sailor and a marine) stopped by during the party to collect the donations. For more JLab holiday stories, visit the "On Target" newsletter web page or the "We Hear That" page accessible from the JLab Insider intranet page.

Milestones
for Nov./Dec. 2004

Hello

Kevin Banks, Systems Administrator, Physics Division

Stephen Scheithauer, Project Planner, Office of Project Management

Delvin Whitlock, Administrative Assistant for 12 GeV Upgrade, Director's Office

Goodbye

Zafer Kursun, Accelerator Operator, Accelerator Div.

Edward Martin, Staff Engineer, Accel. Div. (retired Nov. 15)

Sheila Smith, Staff Administrator, Administration Div.

Clara Perdue, Staff Administrator, Phy. Div.

Joan Sage, Staff Computer Scientist, Phy. Div. (retired Dec. 23)

Everyone at JLab urged to attend special safety presentation

All JLab employees, contractors, students and users are strongly encouraged by JLab management to catch "Charlie Morecraft: Saving Lives by Speaking Out," a special safety program to be presented in the CEBAF Center auditorium on Monday, Feb. 7. Special guest Charlie Morecraft will give two riveting presentations: 9 a.m. and again at 1:15 p.m. To best accommodate the JLab population with the limited seating, as many Accelerator Division members as possible are asked to attend the morning session and everyone else is asked to sit in on the afternoon session. **However, attending the presentation (at either time) is the highest priority.**

Morecraft had more than 15 years of experience on the job. He was a good employee — both in the eyes of his union and in the eyes of Exxon Corporation management. He knew all the rules and safety regulations… and he knew all the shortcuts around them. He was certain that nothing could go wrong when he was in control. And he was right… until one day… This is Charlie Morecraft: an ordinary guy with an extraordinary story to tell.

He wants you to know the shocking fact that across this country — every 10 minutes — two people will die in work-related mishaps and about 390 will suffer a disabling injury. And only we can change this statistic. Please attend this powerful testimonial as Morecraft shares his life-altering story — one that leaves his audiences with an increased desire and drive to improve workplace safety.

How to determine Lab status during, after severe weather

There are three ways for employees, users and subcontractors to get direct, current information on JLab's operating schedule during and after severe weather. For updated, recorded messages, call the main telephone number, (757) 269-7100; this line can handle up to 16 calls simultaneously. Or call the JLab Status Line, (757) 232-2000, which can receive up to 20 calls at a time. Or visit the JLab website: www.jlab.org/. Weather closing or delay information will be given as a banner message on the main web page. JLab closing or delay information is also given to local TV and radio stations but JLab cannot guarantee that the information will be posted.

BEAMS seeks volunteers for new, spring activities

BEAMS — Becoming Enthusiastic About Math and Science — Jefferson Lab's unique, immersion classroom experience for 6th, 7th and 8th graders is ready to begin its third quarter of the 2004-05 school year.

"Our new 6th grade activities are being well received by the students," comments Stacy DeVeau, Science Education technician. "And with the new quarter about to start, we are preparing a new round of activities for JLab volunteers to do with the visiting BEAMS students. Everyone — regular and new volunteers and any employee or user interested in seeing what BEAMS is all about — is cordially invited to the BEAMS Quarter III Training Session. We've had wonderful volunteer support with our new format this year (classes coming for one day four times throughout the school year), but we're only halfway there!"

"We are grateful for the wonderful support BEAMS has received from the JLab community," DeVeau adds, "and we hope to see lots of old and new volunteers at our training session."

Third quarter BEAMS activities will focus on the science of weather tools and equipment. Come learn something new and find out how you can be involved during the months of February and March. We'll offer training sessions in the classrooms (VARC, rooms 72 A/B) on Thursday, Feb. 10 at 11 a.m. and again at 1 p.m.

Contact DeVeau at ext. 7560 or email stacy@jlab.org for more information or to reserve a spot at one of the training sessions.

World Year of Physics...

Continued from page 2

for Jefferson Lab, the special theory of relativity provided the theoretical basis that made particle accelerators possible.

"Einstein's contributions to physics in the year 1905 are at the core of charged particle accelerators and colliders. These machines have ushered in the exciting productive era of high-energy particle and nuclear physics in the twentieth century," says JLab Accelerator Division Associate Director Swapan Chattopadhyay.

"Our electrons travel extremely close to the velocity of light, the realm of special relativity," adds Chief Scientist Thomas. "So basically, without Einstein, we wouldn't have the ability to deal with the electrons or know about the photons they emit and be able to use them for physics. It's pretty clear that Einstein, in 1905, set the groundwork for everything we do here."

In particular, Einstein was the first to declare a universal speed limit. Inherent in the special theory of relativity is the idea that nothing may travel faster than the speed of light. "And in our case," explains Accelerator Division Deputy Associate Director Andrew Hutton, "our electrons are moving at about the speed of light in the accelerator. That means that particles going through our accelerator are traveling at practically the same speed in every pass. Without that, CEBAF would not work, because the particles would be traveling at different speeds, and you couldn't keep everything in phase."

"Essentially everything about the accelerator and the experiments we do, you can't analyze, understand or interpret them, or even make the accelerator work without understanding, in your heart, the special theory of relativity," points out Physic AD Cardman.

Physicists continue to use, test and further elucidate the theories first introduced by Einstein a hundred years ago. Here at Jefferson Lab, we're honoring his work by exploring the inner realms of matter that couldn't be reached in Einstein's time by taking to heart and utilizing his contributions to science.

ON TARGET

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