February/March 2004

ON TARGET

THOMAS JEFFERSON NATIONAL ACCELERATOR FACILITY • A DEPARTMENT OF ENERGY FACILITY

Virginia Outstanding Scientist of 2004

Physics Division's Anatoly Radyushkin wins honor with GPDs work

Anatoly Radyushkin, a jointly appointed Jefferson Lab senior scientist and physics professor at Old Dominion University, has been named a Virginia Outstanding Scientist of 2004.

The award recognizes scientists who have made a recent contribution to basic scientific research that extends the boundaries of a field of science.

Radyushkin is an internationally recognized nuclear theorist and a pioneer in the development of generalized parton distributions or GPDs. GPDs are a set of mathematical functions that are allowing physicists to, for the first time, obtain a 3-dimensional snapshot of the inner structure of the particles that make up the nucleus of the atom. This work is giving scientists a glimpse of the structure and dynamics of the basic building blocks of matter.

In recognition of his work, the Science Museum of Virginia and the Office of the Governor named Radyushkin one of the recipients of Virginia's 2004 Outstanding Scientist and Industrialist Awards.

Radyushkin's work falls in the field of quantum chromodynamics (QCD). QCD is a fundamental theory that addresses the underlying structure of nucleons — the protons and neutrons that makeup the nucleus of the atom — in terms of their more elementary constituents. Nucleons are made up of quarks and gluons, elementary particles referred to as partons. Generalized parton distributions are functions that physicists can use to map the location and momentum of the quarks and gluons inside a nucleon.

The functions are being developed with information obtained from elec-

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Joint JLab/ODU physicist wins Virginia's top scientist award...

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tron-nucleon collisions. In this process, physicists use an accelerator to propel a beam of electrons to speeds approaching the speed of light. When these electrons strike a target, many collide with particles in the nuclei of atoms. Each collision results in an array of scattered particles. GPDs can be applied to those collisions that result in a scattered electron, proton and a photon, an effect called "deeply virtual Compton scattering." Applying GPDs to this scattering pattern reveals information about the structure of the nucleon before the collision. The result is an essentially holographic picture of the inner structure of the nucleon.

"GPDs allow scientists to use an accelerator to get the effective resolution power of an electron microscope and an X-ray installation," Radyushkin says. He says this work has opened a new field of scientific investigation that allows the measurement of the properties of protons and the comparison of these measurements with theoretical predictions. Experiments measuring and testing GPDs are conducted at Jefferson Lab, and the testing of these methods are an essential part of JLab's present and future physics program.

In a letter to Radyushkin, JLab Director Christoph Leemann congratulated him on being recognized as a Virginia Outstanding Scientist of 2004 by the Science Museum of Virginia and the Office of the Governor. Leemann described the award as "a great honor," and he commended Radyushkin's work on generalized parton distributions. "Your theories are contributing to the continued scientific excellence of Jefferson Lab and extending Old Dominion University and JLab's reputation. On Jefferson Lab's behalf, I thank you for your efforts and applaud your work."

Radyushkin completed his pre-doctoral work at Moscow State University in the Russian Federation, and received his Ph.D. in physics there in 1978. He is a permanent staff member of the Laboratory of Theoretical Physics in Dubna, Russia. He joined JLab's Theory Group in 1991 as a visiting senior scientist. Since 1992, he has split his time between JLab and Old Dominion University in Norfolk, Va., as a full professor of physics. Radyushkin is an author or co-author on 90 journal papers in his field, papers that have been referenced in more than 4,400 other publications. He is a member of the American Physical Society and was elected a Fellow of the Society in 1996.

Radyushkin and the six other 2004 Outstanding Scientists and Industrialists were introduced to the Virginia Commonwealth General Assembly on March 2. The honorees will receive their award medallions at a black-tie banquet hosted by Governor Mark R. Warner at the Science Museum of Virginia in Richmond, on March 30.

From the Director

Christoph Leemann
Jefferson Lab Director

12 GeV Upgrade milestone offers challenge, reason to celebrate

Dear Colleagues:

I expect that the DOE will approve within the next few weeks the 12 GeV Upgrade "Critical Decision 0" (CD0, Statement of Mission Need). To arrive at this point many of us have been working hard for a long time, and at many different levels. With the 12 GeV Upgrade, Jefferson Lab has a bright scientific future into the third decade of this century. Achieving this milestone is reason to celebrate, it is also a challenge: funding will be tight and competition fierce. Therefore, our focus must be sharper than ever and we must rekindle the can-do spirit and commitment to excellence that made the creation of JLab possible in the first place.

A sharp focus means a short list of well understood priorities and specific goals that mark the way to achieving these priorities. I will not digress into all the meanings of words such as *priority* and *goal*, but you must understand the essentials. First, when resource conflicts arise, a *priority* trumps a non-priority anytime and without debate. Second, *goals* are not just dreams but management tools: when you embark on any work activity, ask yourself if it will advance your goals; if yes, proceed vigorously, if not, drop it on the spot. In short, to succeed we must become, again, rigorously focused.

To run the best physics program possible and to build and commission the 12 GeV Upgrade are our highest priorities, the irreducible, absolute, essential core of JLab. They must be accomplished concurrently, and in a world of tight resources that may entail compromises. "The best physics program possible" doesn't necessarily mean the most running hours but their wisest allocation to the best experiments, and within the 12 GeV scope choices and prioritizations may be necessary. That means selection, choice, and risk. JLab leadership will make these choices, based on the best external and internal input, advice, and guidance, and will translate them into specific goals for every unit at JLab. My expectation from you is that you will put all your professional pride and energy into meeting our established goals.

Focus, priorities, and goals are great, but their achievement is possible only when our performance is "best in class", when we do not compromise ourselves by safety and security slips, and when each of us delivers on commitments. It is vital that we successfully complete SNS cryomodule production, make good on the promise of CEBAF operation at 6 GeV, and that *all* work units sign up for full adherence to their safety commitments.

"Best in class", "world class", and "outstanding" are words that we use often and casually. To retain "world class" standing we must know the yardstick by which we will be measured and the competition and honestly assess our place in the world community. You know the concept from sports: you qualify for a certain event or you don't, and after the event you know the ranking. We have to measure ourselves in that hardnosed way and learn the lessons. I am happy in this context, that the JLab SRF Institute has completed such a benchmarking exercise and has come up with a quantitative comparison with the world's leader, DESY.

There is the famous choice to call the glass half empty or half full. The national funding priorities may not be to our liking and budgets for science leaner than we hoped. Still, at the level of the FY05 Budget Request, JLab spending over the next five years will approach half a billion dollars. If we are smart, determined, and dedicated we ought to be able to turn those resources into a magnificent outcome.

Flanked by shelves of bound periodicals, the Information Resources group pauses for a photo: (left to right) Carol James, library researcher; Dana Cochran, systems librarian; Kim Kindrew, publications; (foreground) Elois Morgan, IR manager; Tiffany Johnson, student intern; and Deborah Patton, assistant librarian. IR is part of the Chief Information Office.

'Start Here'

Information Resources group works to meet clients' needs

by Judi Tull

If Elois Morgan, Jefferson Lab's Information Resources manager, had her way, there would be a big sign over the library door that says "START HERE."

That's the message Morgan and her Information Resources group want to get out to Jefferson Lab employees, users and students. Although many employees and users have on-line links that they frequently use, the IR group can help individuals and even work groups expand and personalize their electronic information resource capabilities.

"There are new resources popping up every day," Morgan says. "It's our job to know what they are and to make them available."

Morgan, who has been with JLab for 17 years, remembers when she and one assistant ran the library out of a small room in the VARC. Everything was done manually with old-fashioned card catalogues and only hard-copy books and periodicals were available.

In 1998, the library moved to its current location on the first floor of the ARC (Applied Research Center), a move that interrupted library service for just two days. The staff has expanded as well and now includes three full-time professionals and two part-time staff. Full-timers includes Morgan; Kim Kindrew, Publications and Records manager and Dana Cochran, Systems librarian. Part-time employees include Carol James, circulation and document delivery; Deborah Patton, assistant librarian; and student intern Tiffany Johnson, who assists with cataloging and serials.

The library currently holds about 28,000 volumes, and has another 8,000 administrative titles in various locations across the JLab campus. New materials are purchased with Department of Energy money and tracked by the IR Group. That record keeping not only meets regulatory requirements but also prevents duplication and saves money. "Why buy a book if someone already has it?" Morgan points out.

The hard-copy collection is not expanding much these days, Morgan adds, and that's good news because it means that the move toward electronic access is successful. The Lab's employees and users can now access thousands of books and periodicals right from their desktop. "Less physical space is required," she notes, "and best of all, our customers don't waste time on a trip to the library. They can have fingertip access to their own personalized digital library."

Electronic access may be easier for employees and users, Morgan says, but in some cases, it costs more to purchase the services of vendors who package electronic research documents. About half of the group's annual budget goes into those purchases. But Morgan keeps a tight rein on the dollars.

"We carefully determine what our scientists need," she comments. "And I'm a tough negotiator. I'll persist until the vendor makes us a good deal."

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IR offers three new online services

Starting this year, Information Resources is bringing three new electronic services online. The IR staff encourages all Jefferson Lab users, employees and students to discover what these services (Knovel, Safari and Elsevier) can provide, by visiting the IR web page at www.jlab.org/IR/.

"Our goal is to become a fully digital library," says Elois Morgan, IR manager, "to meet the needs of our scientists, engineers, technicians and students for immediate, easy-to-access information. We are a resource for everyone on campus."

Knovel (over 800 titles) is the only online scientific and technical reference book source that contains fully interactive tables, graphs and equations. Someone accessing it may search electronic versions of a broad range of technical reference books from publishers such as CRC, Wiley, McGraw-Hill, etc. These services are currently active from the IR web page. Morgan plans to bring a Knovel representative on site to provide training on Knovel services and capabilities.

Safari Online Tech Books is an electronic reference library for programmers and IT (information technology) professionals. Safari provides web-based access to more than 1400 reference books from major publishers such as SUN, Addison-Wesley, O'Reilly, QUE', Macromedia Press, SAMS, and PeachPit Press.

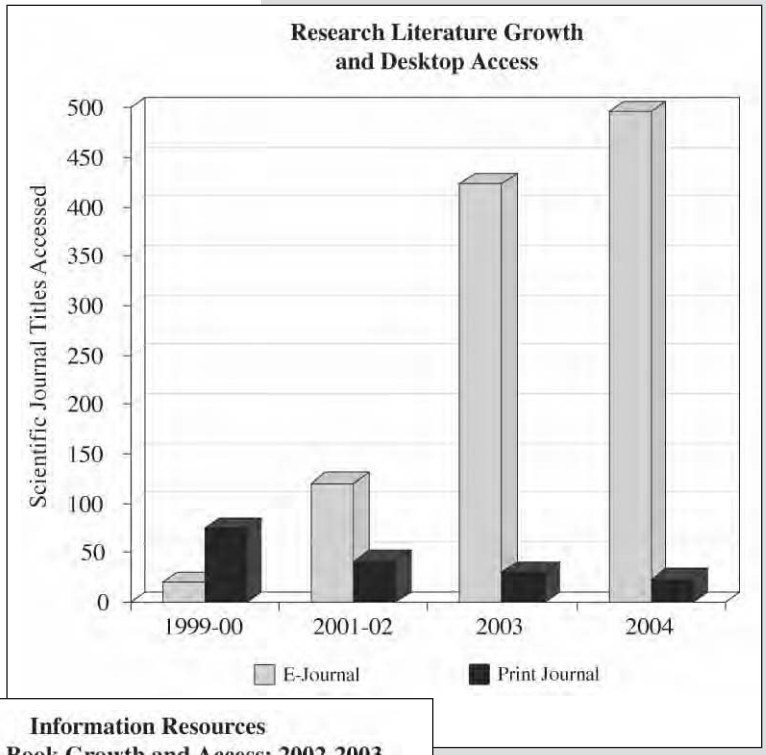
"We haven't purchased IT books up to this point because they become outdated so quickly," Morgan points out, "but now we have a full range of IT books available on-line. Bookmark your favorites and keep them at your fingertips. It is a great way to keep up with software and other IT materials."

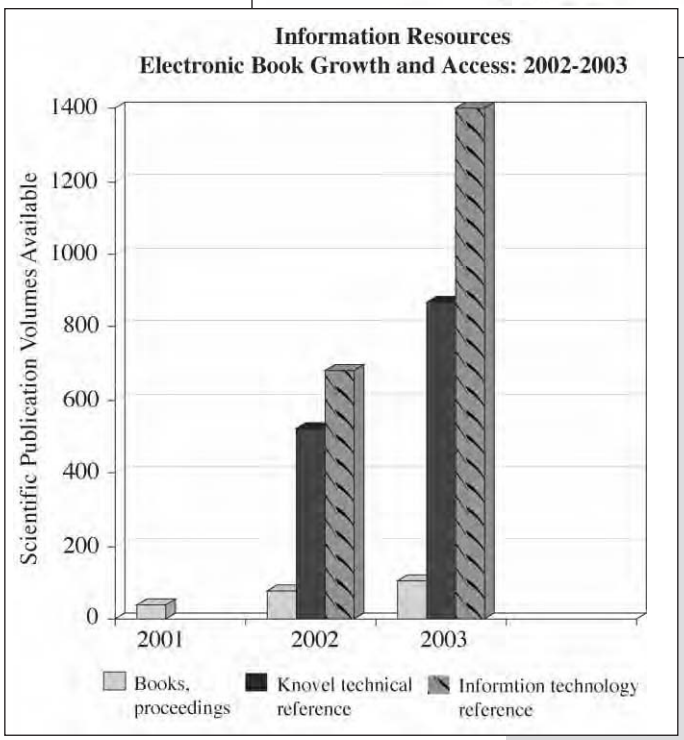
Elsevier's "SciServer" access and Physics Collection are the latest electronic services we have added, says Morgan. "It provides the Lab with an online, comprehensive collection of physics and astronomy titles, and increases by 100 the nuclear physics titles we can access. JLab has also gained access to the vendor's archive, which reaches back to the very beginning of many of these publications."

The server platform for Elsevier is based at Los Alamos National Laboratory. Anyone with a JLab computer account is able to access this service from his or her desktop, according to Morgan. "You can bookmark the information you use regularly and access it from your desktop with near instant availability," she explains. "No more lost or misplaced journals or wasted time. I'm pleased and excited to have made this service available to the Lab. This can be a great resource and time saver for people here."

"Purchasing these package deals can save money in the long run," she adds, "but bottom line, to keep these services, they need to be used. We need our scientists, engineers and technicians to check out these services and give us feedback on their usefulness."

Check it out!





These graphs show the growth and use of IR electronic services at JLab over the last few years.

In their own words

with mechanical engineer, Celia Whitlatch

as told to Judi Tull

I'm originally from Chicago, but we moved to the Phoenix area in Arizona when I was 10. I always liked math, and was good at it, but the path to my job here [at Jefferson Lab] as a mechanical engineer in the Facilities Management group sure wasn't a straight one.

My parents were very strict about school, and education was important to them. My father wanted me to be a pediatrician so in my first year at Arizona State University I was pre-med, on a full scholarship. But when I hit advanced chemistry, I decided medicine wasn't for me. I switched my major a couple of times, and tried engineering but wasn't sure I wanted to focus only on that. A counselor suggested I go into a course of study that would combine engineering and law, but studying law wore me out. I just couldn't take reading case after case after case.

So I decided to focus on mechanical engineering; at first I wasn't even sure what it was, but I grew to really love it.

As the mother of a 6-year-old, I think a key to maintaining interest in the engineering field is to introduce youngsters to this sector at an early age.

My first job was part-time, during my last year of school, at McDonnell-Douglas working with helicopters. Then in 1990 I took a job with Boeing in Seattle, where I worked on 737s and 757s, which was really neat. I was only there about a year when my mother developed cancer for the second time and I returned to Arizona, first on a leave of absence, but then I decided to stay there. It was good to be able to spend time with my mother before she passed away.

I took a job at the Palo Verde Nuclear Generating Station in Wintersberg, about 34 miles from Phoenix. While I was working there, I hooked up with my former McDonnell-Douglas co-workers. We'd always done a lot of hiking and backpacking together — one of my passions. On one of our trips, I met Tim Whitlatch, who's now my husband. Tim left Arizona to come to Newport News for a job with Advanced Technologies, and then came back to propose to me. So I came to Newport News and we were married in 1994.

I first took a job with JJMA, doing pipe design at the shipyard on nuclear submarines. I came to the Lab the following year as a casual employee working about 20 hours a week, doing mechanical design work, and I continued to do that until two years ago when I was hired full time. Tim came to work here in the Accelerator Division three years ago.

We bought a piece of property at York Point with not much more than a shack on it. We cleaned it out and lived in it while we built our own new home. He designed the house; I did the heating and air conditioning. We did everything ourselves except the floors and dry wall, which we contracted out. Unfortunately, Hurricane Isabel flooded the original house and the county says we have to raise it to meet current standards. So our next project is to demolish it, re-build and attach it to our new home.

I love my work. During my years here I've done projects from one end of the site to the other. I do pipe design for low conductivity water (cooling) systems as well as heat, ventilation and air conditioning (HVAC) for new construction. I've done projects on the accelerator site. I redid all the mechanical systems in VARC and served as the project manager overseeing the contractors. I also designed the LCW supply system for the Spallation Neutron Source Test Stand in the Test Lab. And, I am currently the owner's representative for the mechanical engineering portion of the CEBAF Center Addition.

I enjoy designing — do a lot of my own designs — and manage the implementation of those designs throughout the construction process. I do a design and it gets implemented. I get to see my projects through — from drawings to completions.

The guys in my group — Carroll Jones, Dave Kausch, Paul Powers and our boss Bill Rust — the Facilities Systems and Operations Section, are terrific. We've worked together for nine years. We make a point of all going to lunch together once a week. That kind of working relationship is rare.

In their own words

with electro-optical engineer, Chris Behre

as told to Laurina Ramsey Baggett
CNU Public Affairs shadow

I was born in Charleston, South Carolina. My father was in the Navy for 23 years, retiring as a Commander, so we moved around quite a bit. I've lived in Australia, Rhode Island, Virginia, South Carolina and California. When I was 14, we moved to Chesapeake and I have remained in this area except for my own travels with the Navy.

I became interested in the technical field while watching my father as I grew up. He was always fixing things in and around the house, including the cars. As a youngster I was always trying to help him. In high school I took my first electronics course and enjoyed it quite a bit. That's when I knew I wanted to pursue a career in engineering. My German teacher, Herr Bothfeld, was a great influence. He saw my potential and expected more out of me.

When I graduated from high school, I joined the Navy. I was an electrician in the Nuclear Naval Power Program. My courses in the Navy really taught me how to study.

When I got out of the Navy, my wife was working for the American Red Cross as a manager for the Disaster Services Department. This was when I began taking classes at Old Dominion University and volunteering for the Red Cross. I also worked part-time as a laboratory mechanic for Old Dominion University's Physics Department where I maintained the undergraduate lab equipment and demonstrations.

I originally got involved in the Red Cross because it meant so much to my wife. My thinking at the time was that if there ever were a disaster, my wife would certainly be there. So, if I wanted to be with her, I would have to get involved. Of course things worked out differently this time around. She was at my parent's house with our newborn son for Hurricane Isabel.

Once I became involved, it was clear to me that this organization was filling a need in the community. The people we help have no other way to get the basic resources the Red Cross provides: food, shelter and clothing. Once you realize how badly these people need help, it is very hard not to do something whether it is through donations or time. Volunteering for the Red Cross is a way for me to give back to the community and is worth the time given.

I am a Red Cross Logistics chair, which is a support function in a disaster relief operation. During Hurricane Isabel I was the Logistics Site manager and also filled in as the Communication chairperson for the South Side (Virginia Beach, Chesapeake, Norfolk, Portsmouth and some support to Suffolk).

During a disaster like Hurricane Isabel you build a strong sense of community with the people you work with. The bond I have with the volunteers I work with is almost parallel to the friendships I have with the men and women I served with in the Navy.

Wednesday morning prior to landfall, I moved my wife and newborn son to my parent's house and then went to the Emergency Operations Center (EOC) to set up camp. A number of us (volunteers) spent the entire day setting up the command center. (The EOC provides a central location for the Red Cross staff and volunteers to weather the storm and begin Disaster Relief immediately after the weather breaks.) That was when ABC News got footage of us putting out the cots; quite a few people who know me saw the footage and asked me about it.

During Isabel my job consisted of solving problems when they arose. For the first few days it seemed like I was presented with an emergency request every time I turned around. This included everything from getting diesel fuel to the Southern Baptist Disaster Relief Kitchen, which can roll out 10,000 meals a day, to setting up legal agreements for shelters.

I spent 11 days straight helping with hurricane relief, from Sept. 17–27. The first two days were around the clock. I went to my parents' house around 11 p.m. Friday night, and was back to my Red Cross duties by 7:30 the next morning. My days steadily decreased in length over the week. I missed eight days of work due to Isabel.

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Lab hosts 22 teams for Feb. 7 Science Bowl

Thomas Jefferson High School for Science & Technology wins top award

First place at the Virginia Regional Science Bowl on Feb. 7 went to the team from Thomas Jefferson High School for Science and Technology, Alexandria, Virginia. Team members include (left to right) Kay Aull, Michael Zhang, Paul Yang, Samuel Lederer (behind), Team Coach Sharon Baker, and Lisa Marrone.

The intensity was palpable. Fourteen rounds of multiple choice and short answer science and math questions conducted over seven hours culminated in an academic face off between the reigning champs, Thomas Jefferson High School for Science and Technology, and Charlottesville High School at the Saturday, Feb. 7, Virginia Regional Science Bowl.

Twenty-two teams — 109 students, with their 26 teachers (coaches) — converged on Jefferson Lab to participate in the daylong regional academic competition. Many teams from outside the area started arriving the evening before to avoid wintry weather forecast overnight for northern and western parts of the state.

Charlottesville entered the Finals with one loss while TJHSST was undefeated. Just over 20 minutes later, TJHSST fell to Charlottesville, 22 to 48, marking the team's first loss of the day, and effectively causing a tie between the two teams, which required a 2nd Finals Round.

After their shaky performance in the previous round, the TJHSST team from Alexandria seemed to get a second wind and trounced Charlottesville, 76 to 8 in the last round. The win marked the third consecutive time TJHSST has taken the regional competition at Jefferson Lab, and ensures the team a berth at the Science Bowl Nationals to be held in Washington, D.C., April 29–May 3. The Nationals have been sponsored annually since 1991 by the U.S. Department of Energy.

Placing third in the event and taking home a trophy and check for $500 was St. Stephen's & St. Agnes School from Alexandria. For their second place finish, Charlottesville High School from Charlottesville received a trophy and a $750 check. First place honors for TJHSST came with a banner, individual medals, the team trophy and $1,000 to be spent on the school's math and science programs.

Pulling in a strong fourth was the New Horizons Governor's School based in Hampton. In addition to the academic competition, the event included Stay-All-Day Activities for the teams that didn't make it to the afternoon's double-elimination rounds. The brain-teaser activities included building a structure out of spaghetti, assembling a model airplane and flying it, and encasing an egg and dropping it from a distance to see which

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Volunteers needed for April 23 event

JLab prepares for its first Middle School Science Bowl

Jefferson Lab will host its inaugural Virginia Regional Middle School Science Bowl on Friday, April 23. According to Jan Tyler, Science Education program manager and science bowl coordinator, eight teams are currently registered to compete; and 20 volunteers are needed to help with the daylong academic event.

"This will be a much smaller event that the high school science bowl hosted here Feb. 7," Tyler explains. "By 4 p.m. we'll be down to one team. The top three teams will earn cash prizes for their respective schools; and the top team wins a trip to Golden, Colo., to compete in the National Middle School Science Bowl in June."

"Middle school is a great time to excite students about math and science. This event is 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 is an academic competition among teams of middle school students who answer multiple-choice and short-answer questions on a variety of scientific topics (life science, physical science, mathematics, space science and earth science). Each team is made up of five students, and a teacher who serves as advisor and coach.

The volunteers will perform as moderators, rules judges, timekeepers and scorekeepers during the round-robin sessions, Tyler says. She'll also need several volunteers to act as the on-site scientific team, to be called when a student challenges a question or answer during the competition.

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/.

All participants, including volunteers, will receive a "Zoom into Science" T-shirt. Volunteers are needed from 9:30 a.m.– 4 p.m. Individuals interested in more information or in volunteering may contact Tyler, e-mail tyler@jlab.org or call ext. 7164.

Thomas Jefferson High School wins Feb 7 event...

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team could prevent the dropped egg from breaking. The overall winner of the Stay-All-Day Activities was Walsingham Academy from Williamsburg.

"The event was a huge success," noted Jan Tyler, Jefferson Lab Science Education manager and Virginia Regional Science Bowl coordinator, "and we couldn't have done it without the hard work of so many JLab volunteers — 55 staff, their family members and users. Many were at the Lab by 6 a.m. and several were still hard at work at 5 p.m."

"Supporting this annual event gives us the opportunity to encourage and motivate young minds," Tyler added. "By hosting the Regional Science Bowl, Jefferson Lab is able to show support for science education in Virginia and to encourage our youth to pursue a higher education and careers in science and math."

In their own words

With Richard Dalitz Emeritus Professor of Oxford University

The man behind the Dalitz plot: Australian-born physicist Emeritus Professor Richard Dalitz of Oxford University began his research career as a fluid dynamicist, then shifted to the study of elementary particles, the quark model and quantum chromodynamics (QCD). Now retired, Dalitz continues his work in nuclear physics, particularly in particle and hypernuclear physics. He spoke with Jefferson Lab science writer Melanie O'Byrne during the 8th International Conference on Hypernuclear and Strange Particle Physics held at JLab in October 2003.

Professor Dalitz, welcome to Jefferson Lab. What brought you here?

I wanted to see this new kind of accelerator you have. This is my first visit, to attend the hypernuclear conference (HYP2003). A hypernucleus results when one or more nucleons in a nucleus are replaced by heavier baryons called hyperons. There are many physicists interested in this subject.

I'm long retired, but I still follow nuclear and particle physics, and I have contributed quite a lot to hypernuclear physics in the distant past.

Let's start at the beginning. Where were you born?

I was born in Dimboola, in the State of Victoria, Australia. Back then, it was a town of about 2000 people, but more like 1000 today. It is sited on the Wimmera River, which carries to the north, rainwater falling inside the Great Dividing Range of Australia, until it sinks into the sands. My mother, a schoolteacher, was very keen that her children should have an education in Melbourne. We moved there when I was two years old; all of my schooling was in Melbourne. At Melbourne University, I took a Bachelor of Arts (Honours Mathematics) and a Bachelor of Science (Physics) and then I took my Ph.D. in Cambridge.

How did you become interested in science?

I was always interested in mathematics. Physics was a later interest, since it involved the use of mathematics.

What led you to Cambridge?

In 1946, I was awarded the Aitchison Travelling Scholarship of Melbourne University. I married at age 21 and took my wife with me [to Cambridge]. My supervisor there was [Nicholas] Kemmer and my first aim was to learn how to use quantum mechanics. There wasn't much knowledge of that in Melbourne, in those days.

What sparked your interest in quantum mechanics?

Quantum mechanics was essential for research in physics. [Paul] Dirac's "The Principles of Quantum Mechanics" was the book to study. Its first edition (1930) was sparse in words and very difficult to read. The second edition, much more readable, was rewritten in 1935 but was unobtainable after the war. Dirac lectured from third-edition proofs in 1946 and I attended a second time in 1947, with my own copy. Mrs. [Lady Bertha Swirles] Jeffreys also gave very intelligible and useful lectures. Lectures were not required for postgraduate students; we went along out of interest.

What was your Ph.D. thesis work?

Its title was "Zero-zero transitions in nuclei." Primarily it was a study of the transitions from the first level of oxygen, which has spin-parity 0^+, to the ground state, which also has 0^+, together with a number of other topics added as appendices.

Was your thesis entirely theoretical?

Yes, it was but it stemmed from experiments by [Samuel] Devons at the Cavendish Laboratory. After two years at Cambridge, I ran out of money. We had a young child at that time, so I took up a one-year post at the University of Bristol.

What came next?

I was a student assistant to Professor [Sir Nevill] Mott. He began in nuclear physics in the early 1930s but many students at the Cavendish Laboratory consulted him (himself a student) about their solid-state physics research. He did this so well that he became quickly known as a solid-state physics expert. He never found time to take a Ph.D. himself.

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However, he recognized the high quality of the research being done by the Cosmic Ray Group on the fourth floor of the Physics Department at Bristol University. He wished to know more about this work and perhaps even to take part in it. This was the group of C.F. [Cecil Frank] Powell, who not long before had identified the pion as Yukawa's nuclear-force meson. It was there that I learned about elementary particles first-hand, because they were the people finding them. Mott was in such demand in solid-state problems that I never managed to help him make the transition back to nuclear physics.

At Bristol I got involved in problems of cosmic-ray particles. I took a particular interest in the "tau meson," which we call the K^+ meson today. That tau meson decayed into three pions. I started collecting evidence about them and their decay configurations. Although I thought a lot about them, I did not do any work on them until I had completed my thesis in 1960, more than a year later.

This year at Bristol was vital for my development in many ways, a very important year for me, in my opinion. I was invited to join the department of Professor [Rudolf] Peierls at Birmingham University. My first year there was mainly occupied with completing my thesis work. I was also learning how to use the quantum-electrodynamical methods of [Richard] Feynman, which I used to generate a number of appendices to my thesis.

Did you stay at Birmingham after completing your thesis?

Yes, I wrote the thesis in the first year, then I was a research fellow and later a lecturer. It was a strong group, centered on Peierls. This was his style; Peierls supervised all of the students. He had a wide range of understanding in physics and in life.

I was very lucky. [Freeman] Dyson, who had worked in America showing that the theoretical formalisms of Feynman and of [Julian] Schwinger were equivalent, did so on a UK Fellowship that required him to return to England after his work there. He chose to work at Birmingham. He was in a fairly relaxed state then, because he'd done his most important work, and so he had an amount of time to talk with me now and then. His presence, and my contact with him, was considerable and important for me.

I did my work then [in 1951] on the neutral pion decay, to a photon and an electron-positron pair [the "Dalitz pair"]. Before moving on to the tau-meson decay, for which I devised a convenient representation…

…***The so-called "Dalitz plot." How did you come up with that?***

The Dalitz plot is a kind of map, summarizing all of the possible final configurations, each dot representing one event. I came at it from a geometrical perspective because I visualize geometry better than numbers. The idea was convenient then for all systems decaying into three particles. Tau-meson decay to three pions is particularly simple. With parity conservation (P), I used the plot to show that if the tau meson was also capable of decay to two pions, then the three-pion plot should show special features, which are absent in the data; and also to show that the tau meson had zero spin. If the K^+ meson can decay to three-pion and two-pion states, then these two final states must have opposite parity. These facts were the first intimation that P might fail for weak decay interactions.

When did you visit Cornell University, from Birmingham?

I was at Birmingham University from 1949 to 1953. Then I was given two years leave to work in America, primarily at Cornell University in Ithaca, New York, in the group of Professor [Hans] Bethe, at his invitation. He was a tremendous stimulation. Our names appear together on one paper, but our contributions were made at different places and different times. My work was mostly on pion-nucleon scattering and the production of pions. I was also very fortunate to be able to work at a number of places for short periods. I spent one summer at Stanford University, another at Brookhaven National Laboratory and one semester at the Institute for Advanced Studies at Princeton.

And when did you go to the University of Chicago?

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In their own words with the man behind the Dalitz plot...

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I joined the faculty of the University of Chicago and its Enrico Fermi Institute for Nuclear Studies in 1956. After Fermi died in 1954, a number of senior theoretical physicists left Chicago — [Murray] Gell-Mann went to CalTech, [Marvin] Goldberger went to Princeton University, and there were others. Those appointed to senior posts at the University of Chicago then had a tremendous opportunity — to build up groups again and get things going, with the junior faculty still to be appointed. There were quite a number of good students there, too, many from other countries.

My interest in hypernuclear events developed particularly well in Chicago because a young emulsion experimenter, Riccardo Levi-Setti, whose work I had known from his hypernuclear studies at Milan came to the Institute for Nuclear Studies at this time. We each benefited from the other, I think, and we got quite a lot done.

Did all of this happen over just two years in Chicago?

No, I was connected to the University of Chicago for 10 years in all. I enjoyed Chicago. I thought it a very interesting place and a very fine university. I approved of the way the university did things, although the place wasn't very fashionable with American physicists. At that time, they tended to go to the East Coast or the West Coast. Relatively few of them were interested in being in the middle of the country; perhaps more do these days.

After Chicago, you went to Oxford University…

Peierls became the Wykeham professor of theoretical physics in Oxford, where there had not really been any central department for this. There were some individual theoretical physicists, but only a small number. Peierls brought all that together, and he was very keen for me to go back with him to Oxford.

I became a research professor of the Royal Society. They have no buildings for research, but they had funds and could appoint some researchers to be in various universities. I was responsible for organising particle-physics theory in Oxford. Besides quark-model work, I still did work on hypernuclear physics, much of it with Avraham Gal of Jerusalem.

Life became increasingly busy as the years went by. I was attached to the Rutherford High-Energy Laboratory, as it was called in those days. They had their own accelerator and I was their adviser on theoretical matters. That was quite a happy arrangement, also.

I believe you taught Frank Close, who visits JLab from Oxford regularly. How was Frank as a student?

[Laughs] Well, we didn't always agree on things … but I think we're getting closer now!

I've heard scientists call you the "father of QCD." Do you think that's fair to say?

Oh, no. I wouldn't claim that. I first heard quark colours mentioned in a seminar by Gell-Mann. I just picked up the ball very quickly since this concept immediately resolved some deep difficulties with the quark model that we had adopted in 1965. Of course, many people wouldn't give any credence for the quark theory at that early stage but I was always interested in it, and others came to Oxford to join in the work. Nathan Isgur and Frank Close, were also interested in it.

As time passed, heavier quarks, charm (c) and bottom (b), became established and we became interested in the spin correlations between the quark and antiquark jets from electron-positron annihilation events. Finally we came to the top quarks, for which these effects would probably be quite different.

What was your involvement in the discovery of the top quark?

Two groups at the Tevatron (Fermilab) were doing experiments at sufficiently high energies to find the top (t) quark but little was known about their progress. We — myself and Gary Goldstein (at Tufts University) — thought about the problems of how one might identify tops and antitops from the decay processes that seemed most natural for them, and worked out a geometrical method by which experimental data could be used to deduce the top quark mass.

Continued on next page

IR group works to meet your needs...

Continued from page 4

One of the newest innovations is a web-based professional paper clearance procedure. With this system, publications can be tracked and reviewed by staff from the department level up to the division level, ensuring that all papers meet the proper submission requirements before being sent to the publisher and then to the Department of Energy for distribution to the world scientific community.

"In this way, we can be sure that nothing is distributed to the physics community without proper review," Morgan says.

The IR group is also tasked with keeping track of many of the records that must be maintained across the Lab. Documents are inventoried and scheduled for their appropriate retention period. "When a file cabinet overflows, you can't just throw it out," Morgan explains.

IR group member Carol James provides another valuable service to assist employees. She is the library researcher in charge of document delivery and can find just about any type of information a scientist may need from external services.

IR's newest staff member is Dana Cochran, Systems Librarian. "You can't have an electronic library without a Systems Librarian. She makes sure our digital library and electronic resources are functioning correctly and accessible whenever you want them. Dana is a Management Information System (MIS) member who works on IR systems as a major part of her responsibilities," Morgan explains.

A library committee of 12 people representing all the divisions, and including Morgan, oversees all library operations. The committee's recommendations have been influential in increasing the availability of scientific publications. In the past, supervisors appointed employees to the committee for the standard two-year term. Now, Morgan seeks out people who are interested in the library's work and invites them to join. The committee meets quarterly.

During National Library Week, April 18-24, 2004, the IR group's push to get the word out about what they offer will intensify. Morgan says they'll be beating the drum to educate their customer base. "Our biggest challenge is always marketing our services," she says. "We want to let people know we're here, what we can do for them, and that they don't have to walk over here."

If you do want to walk over, the library is open 24 hours a day with the simple swipe of your JLab ID card. And if you have any overdue books, don't worry about a fine. You can just drop that book you've borrowed in the drop slot when nobody's looking!

The man behind the Dalitz plot...

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It was known that there was one event that seemed to have the features needed — this had been shown at a conference by the Collider Detector Facility (CDF) group at Fermilab — but which the CDF experimenters would not accept as a possible top-antitop production and decay event.

Since they wished to determine the top pair-production cross-section, they had laid down fiducial limits for such events. However, these limits were not always relevant for determining the existence and mass of the top quark. Knowledge of this one event made us think very hard about devising this method — empirical data drives the theoretical mind! We tried out our method, with the conclusion that, if this event were top-antitop production and decay, the top quark mass must be greater than about 130 GeV, an unexpectedly large value. But of course this one event might not have been a top-antitop event. This could only be decided on the basis of a large number of observed events, all of them being consistent with a unique mass, and this was the case when the two experimental groups came to conclude later that the top mass was about 180 GeV.

You've had a lot of good fortune and hard work along the way!

Yes, I know … I'm very aware of that. I have been lucky.

Briefs

Milestones
for Jan. – Feb. 2004

Hello

Venkata Jagannath, Programmer, Chief Information Office

Edvard Pozdeyev, Staff Scientist, Accelerator Division

Alexandre Deur, Hall B Staff Scientist, Physics Div.

Julian Gordon, Technical Facilities Coordinator, Accel. Div.

Kandice Carter, Science Writer, Director's Office

Thomas Briggs, Property Manager, Administration Div.

Goodbye

Vicki Barnett, Administrative Support, Admin. Div.

Curtis Thomas, Staff Engineer, Accel. Div.

Sylvia Smith, Administrative Support, Chief Financial Office (Retired)

Sridevi Konduri, Staff Computer Scientist, Accel. Div.

Jacek Sekutowicz, Senior Staff Scientist, Accel. Div.

Congratulations

Eric P. Hanson, Accelerator Division's EH&S Associate Coordinator and Industrial Safety Group Leader, completed all requirements to become a Certified Safety Professional during 2003. Hanson met specific academic standards and professional safety experience requirements as part of the certification process. He also passed two rigorous examinations — totaling more that 10 hours — that covered engineering and management aspects of safety, applied sciences, legal and regulatory matters, professional affairs and ethics, and other safety-related topics. CSP status is awarded by the Board of Certified Safety Professionals, headquartered in Savoy, Ill. Hanson has been with JLab for nearly 16 years. He joined JLab's Environmental, Health and Safety team in 1995, started the CSP process in 1996 and is now one of only three JLab employees holding the certification.

Late in 2003, Theory visitor Pervez Hoodbhoy, of Quaid-e-Azam University in Islamabad, was awarded UNESCO's Kalinga Prize for 2003 for popularizing science in Pakistan with TV serials; and his film "The Bell Tolls for Planet Earth" won honorable mention at the Paris Film Festival. He received the Kalinga award including an Albert Einstein Silver Medal at the annual World Science Day celebration in Budapest, Hungary, Nov. 10.

Sylvia Smith, long-time employee retires

Dozens of JLab employees gathered in the VARC on Feb. 17 to celebrate the career and contributions of long-time staff member, Sylvia Smith. She retires from her current position, administrative support, in the Chief Financial Office with more than 19 years of service to the Lab. She was among the first group of employees to reach 15 years employment at the Lab.

After being beset with illness that she has fought with incredible spunk, she reluctantly decided recently that in the best interest of her co-workers she would take early retirement. 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 make Sylvia Smith the indomitable woman she is.

On the lighter side, they mentioned her love of impossibly high-heeled shoes, her move to sensible shoes when she joined Finance, the recognizable sashay of her walk as she went down the hall, her love of Blue Sheets, her rubber stamp and the Redskins, and her readiness to volunteer at any JLab event.

Cake was served, gifts bestowed and Pam Turk, Chief Finance Office, waxed poetic in honor of Sylvia.

"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." Oh goll!

One Science Series event left this season

JLab has one Science Series event remaining on the calendar.

The final event of the season will be Tuesday, April 20, (please note change of date from Apr. 6) and features William Hammack, of the University of Illinois and National Public Radio host of the "Engineering Guy" program, discussing **"The Hidden World of Technology."** From the moment the clock radio comes on in the morning to the time we shut off the last light at night, a hidden web of technology supports and sustains us. Hammack takes the first half hour of his day to show his audience the com-

Continued on next page

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plex web of technology underlying it. In addition to the technical aspect, he explores the social, political, economic and cultural context of the material things surrounding us.

Science Series presentations begin at 7 p.m. in the CEBAF Center auditorium. The events are free and open to anyone interested in learning more about science. For security purposes during Science Series events, enter at JLab's main entrance (Onnes Dr.). Everyone over 16 is asked to carry a photo ID and security guards may perform ID and vehicle checks. For more information, visit http://education.jlab.org/scienceseries/currentseries.html.

Flyer posting guidance for CEBAF Center

To preserve the newly painted/repapered hallway walls, public areas and doorways in CEBAF Center, guidelines have been set for poster and flyer posting in CEBAF Center. Excessive use of tape and thumbtacks on walls and doors caused extensive surface marring and holes.

All posters and flyers developed and/or printed by any office or activity at JLab should include:

- An obvious event date (or an expiration date annotated in the lower right-hand corner of the poster/flyer)
- The last name or office name and telephone extension of the person responsible for generating the flyer also printed in the lower right-hand corner.

All posters and flyers posted in CEBAF Center may:

- Be posted on bulletin boards, and
- Be posted, using magnets only, on metal bathroom and exit doors.

Items posted otherwise may be taken down. Please don't tack or tape posters or flyers on doors, walls, or window surfaces. If you see an area needing magnets, contact Debbie Magaldi, magaldi@jlab.org, ext. 5102. Any group needing new or additional bulletin boards in CEBAF Center may also contact Magaldi.

JLab plans annual Take Our Children to Work Day; seeks volunteers

Jefferson Lab's Take Our Children to Work Day is set for Thursday, April 15, from 8:30 a.m.– 4:45 p.m. The day will include career exploration and hands-on science activities based on the theme "Discover Engineering."

Children and grandchildren of Jefferson Lab employees, contractors and users who are in grades 1 through 6 may attend. "All children must be registered by 5 p.m. April 9 in order to participate," notes Dawn Manning, Science Education administrator. The electronic registration form and the day's itinerary can be found at: http://education.jlab.org/children/.

The cafeteria plans to serve special kids' meals that day. "The time between 11:45 a.m. and 1:30 p.m. will be set aside for parents to have lunch with their child(ren)," Manning says.

The day will begin in the VARC lobby. Parents are reminded that they must promptly pick up their children from the VARC lobby for lunch (11:45 a.m.) and at the end of the day (4:45 p.m.).

"Volunteers make this event a success," she says. "All types of engineers are needed in the morning to provide career exploration (office or work area visits). Additional volunteers are needed to escort groups in the morning and to help with afternoon group activities.

Contact Manning, ext. 7633, dmanning@jlab.org, for more information or to volunteer to help.

Get current JLab opening info during, after severe weather

In the event of severe weather in this area, the following methods provide the most current information on Jefferson Lab's work/operations schedule:

- Visit the JLab website (www.jlab.org/) for work delay or closing announcements.
- Call JLab's new Status Information Line (757) 232-2000 for a recorded message of the most current information. This line can receive up to 20 calls at a time.
- If for any reason you don't get an update from 232-2000, dial JLab's main switchboard number, (757) 269-7100. Severe weather update messages will also be placed on this line, which can handle up to 16 calls simultaneously.

Plan now to be a part of QNP2004 Conference

The International Conference on Quarks & Nuclear Physics (QNP2004) will take place May 23–28, 2004, in Bloomington, Indiana.

According to Alex Dzierba, University of Indiana and JLab's Hall D Glue-X spokesperson, the conference will cover topics that lie at the intersection of particle and nuclear physics, including, among others, quark confinement and non-perturbative QCD (quantum chromodynamics), structure and spectroscopy of hadrons, lattice QCD, effective theories of hadron structure, in-medium effects, and hadron dynamics under extreme conditions. For more information visit the conference website at www.qnp2004.org/.

The event is being co-sponsored by the Department of Energy, the National Science Foundation, Indiana University and JLab.

In their own words with Chris Behre...

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The most memorable experience for me happened Saturday night after the storm. Five other volunteers and I delivered ice and bottled water to a trailer park and an apartment complex. Without power, people had been begging for ice. Earlier that day we had received an 18-wheeler of ice from BB&T. It was already 9 p.m. and very dark, but what damage I could see was horrific. I saw a trailer that had the entire backside, ripped off by a tree, with a family of 4 or 5 still living in the structure. They asked about available shelters and other assistance. I told them about the Red Cross shelter near by. It felt great to be able to help these people and to see our efforts provide them with some relief.

Other than volunteering for the American Red Cross, I enjoy sailing. I even lived on my sailboat for two years while in the Navy. Then I got married and had to move off.

In 2002 I received my degree in Electrical Engineering from Old Dominion University. I was first introduced to JLab in 1999 when my wife and I took a tour of the facility. This was when I found out about the FEL (Free-Electron Laser) program. In the summer of 2000 I received a Department of Energy Undergraduate Research Fellowship. I was hired as an intern in the FEL Optics Group in 2001, and I supported outside experiments and worked on the active feedback system. Currently I am working in the FEL Optics Group as an Electro-Optical Engineer. I am continuing my work on the development of the Optical Cavity Mirror Metrology system (OCMMs).

I have been very fortunate to work for Michelle Shinn, Optics Group Leader. She is a very positive person and always excited about her work. Her enthusiasm and optimistic outlook are contagious and make work exciting! Just meeting her made me want to be a part of the FEL program. Next fall I hope to pursue my Master's of Science in Engineering Physics with the University of Virginia.

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Editors
Linda Ware
Debbie Magaldi

Contributing Writers
Melanie O'Byrne
James Schultz
Judi Tull

Photographer
Greg Adams

Check Us out on the Internet
www.jlab.org

Jefferson Lab/MS 12C
12000 Jefferson Avenue
Newport News, VA 23606

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