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Each day began with three, one-hour talks covering background and current understanding in one of the 10 puzzles. After lunch, students returned to Panofsky Auditorium to hear researchers from around the world report their latest advances on the puzzle of the day.

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See whole story...

Get Ready for SLAC Family Day: Our Universe, Large & Small

Saturday, September 18
11:00 a.m. – 3:00 p.m.

Everyone in the SLAC Community is invited! Please use Web form for lunch reservations, activity sign ups and to pre-order t-shirts.

Preliminary Program Highlights

ENTERTAINMENT, MUSIC AND MORE ON CENTER STAGE

Welcome: SLAC Director Jonathan Dorfan

DJ Eddie McGee (RP): Music for dancing and zany entertainment

See whole story...

The Stanford Linear Accelerator Center is managed by Stanford University for the US Department of Energy

Last update Thursday September 02, 2004 by Emily Ball

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As many of you know, the worldwide high energy physics community has reached an important milestone on the path to building an electron-positron linear collider, a facility that will unlock some of nature's greatest mysteries.

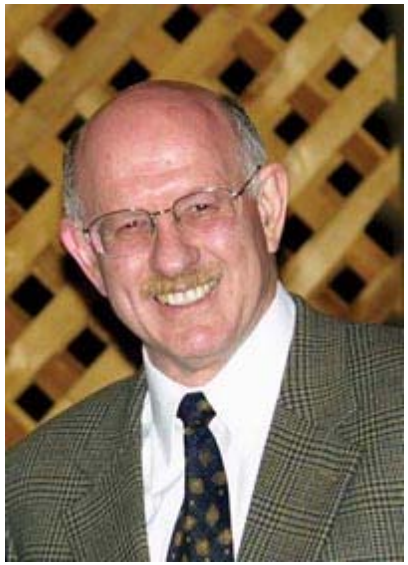

Photo by Diana Rogers

The International Technology Recommendation Panel (ITRP), after eight months of very hard work, recommended on August 19th that superconducting ("cold") technology, rather than conventional room temperature copper("warm") technology developed by SLAC and its Japanese partner KEK, be used for the linacs that will have to accelerate the electrons and positrons to record energies of 500 GeV. ICFA, the International Committee on Future Accelerators, which was meeting in Beijing last week, unanimously accepted this recommendation and made it official.

The ITRP declared that both superconducting and room temperature technologies were viable and mature, and praised all the talented and dedicated teams which have worked on the research and development of these technologies for many years. A rational selection could not have been made unless both (and actually other variations of these) approaches had been carried forward to a mature point where an educated comparison was possible. It is also important to understand that the ITRP recommended the cold technology, but did not recommend a specific design (such as the TESLA design by DESY, the German lab that developed the cold technology). The Panel also strongly recommended pooling the resources and know-how of the two groups, warm and cold, to produce the best possible new linear collider design.

The decision has significant implications for SLAC. We are certainly disappointed that our warm technology was not selected. However, the high energy physics worldwide community has taken a huge and necessary step forward by making this selection, and has crossed a critical threshold in the realization of the dream that SLAC helped initiate—building a frontier energy linear collider.

The path forward is exciting and we remain an enthusiastic champion of the machine. As the only laboratory to have built a linear collider, the SLAC Linear Collider, we have expertise and experience in most areas critical to the linear collider design. Our expertise and experience with the warm technology transfers

Back row (left to right): FNAL Director Mike Whitherell, CERN Director General Robert Aymar, KEK Director Yoji Totsuka, Won Namkung (ALCSC), Brian Foster (ECFA), Giorgio Bellettini (ITRP), SLAC Director Jonathan Dorfan, Chen Hesheng, (IHEP Beijing), DESY Director Albrecht Wagner, Maury Tigner, (ILCSC) (Photo by Neil Calder)

naturally and powerfully onto the design based on cold cavities.

This multi-billion dollar machine can only happen if the three regions of the world (North America, Europe and Asia) come together and pool their human and fiscal resources. We still have to take on tough technical and organizational issues to move the collaboration forward, to continue to show international commitment to the collider, so as to get the support of the many governments that are needed to fund the design and construction of the linear collider.

The International Linear Collider (ILC) is the new name for this bold global project. All previous names (NLC, JLC/GLC and TESLA) will be retired. The ILC will be a complex machine with many different elements. It needs teams of people with broad expertise. The machine will have sources to produce electrons and positrons, damping rings to prepare the particle bunches, two main linear accelerators to accelerate the bunches, two final focus regions, the collision point where electrons and positrons smash into each other, and the detectors to record the collisions.

The assessment of our worldwide partners and the ITRP is unequivocal on one point: as we now form the International Linear Collider design effort, SLAC, because of its past experience and broad knowledge about linear colliders, has a unique contribution to make. This view is shared by our government partner, the Department of Energy.

In November 2004 we will form the ILC collaboration at a workshop at KEK, which will bring together all the interested worldwide partners. The collaboration will initially proceed using the funding we have in place. By the end of the year, we plan to identify a Director for the central design effort. This Director will lead the Global Design Initiative, with regional coordinators from each geographical area. After the design is finalized, the next step will be to have one or several governments come forward with an offer to host the facility. If all goes well, the physics community could have a machine by 2015.

The Office of High Energy Physics in the DOE is backing our lab very strongly to move forward. I anticipate the same financial level of support for the ILC effort at SLAC in 2005 as we had this year. I am hopeful that, with this decision to consolidate the worldwide effort, we could see growth in funding that supports the ILC design in the years 2006 through 2009. We currently have 100 full-time-equivalent staff working on the linear collider, representing roughly half of the worldwide effort.

For a while, it will not be completely business as usual. We do have to reorient the activities that have been specific to our warm technology to work on the new design. The linear collider test facility (NLCTA) here will play a different role as we move forward. We need time to assess what will be closed out and what will be retained. There are numerous opportunities and a lot of work to do. SLAC is vigorously pursing a plan for

our role in this exhilarating venture.

Let me encourage you all to embrace the ILC opportunity with enthusiasm so that SLAC can continue to be a leader in the worldwide community as it moves toward the construction of a machine that will reap tremendous physics benefits after it is completed.

For the full text of the ICFA press release, see http://www.interactions.org/cms/?pid=1014290.

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INTERACTIONS.ORG
PARTICLE PHYSICS NEWS AND RESOURCES

A COMMUNICATION RESOURCE FROM THE WORLD'S PARTICLE PHYSICS LABORATORIES

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International Panel Recommends "Cold" Technology for Future Particle Accelerator

Beijing, China—The International Committee for Future Accelerators (ICFA), meeting during an international physics conference here, today (August 20) endorsed the recommendation of a panel of physicists charged to recommend the technology choice for a proposed future international particle accelerator.

The 12-member International Technology Recommendation Panel, chaired by Barry Barish of the California Institute of Technology, recommended that the world particle physics community adopt superconducting accelerating structures that operate at 2 Kelvin, rather than "X-band" accelerating structures operating at room temperature, as the technology choice for the internationally-federated design of a new electron-positron linear collider to operate at an energy between 0.5 and 1 TeV.

"Both the 'warm' X-band technology and the 'cold' superconducting technology would work for a linear collider," the ITRP's Barish said. "Each offers its own advantages, and each represents many years of R&D by teams of extremely talented and dedicated scientists and engineers. At this stage it would be too costly and time consuming to develop both technologies toward construction. The panel had our first meeting in January 2004 and started our evaluation of the two technologies. The decision was not an easy one, because both technologies were well advanced and we knew the selection would have significant consequences for the participating laboratories. On the basis of our assessment, we recommended that the linear collider design be based on the superconducting technology."

George Kalmus, an ITRP member from the UK's Rutherford Appleton Laboratory, explained the cold technology.

"The superconducting technology uses L-band (1.3 GHz) radio frequency power for accelerating the electron and positron beams in the two opposing linear accelerators that make up the collider," Kalmus said. "The notable feature of this machine is the use of pure niobium cavities for the accelerating structures of the collider. These cavities at their operating temperature have almost no electrical resistance; that is, they become superconducting. When this occurs, the transfer of power from the drive klystrons to the electron and positron beams becomes highly efficient. The proposed collider would occupy a tunnel of up to 40 km long with the experimental areas located at the midpoint, where the electrons and positrons collide."

In accepting the ITRP recommendation today, Cornell University's Maury Tigner, chair of the International Linear Collider Steering Committee, which appointed the panel, thanked them for their work.

"A decade ago such a high-energy linear collider was just a dream—a vision for a revolutionary tool to answer some of the most fascinating and compelling questions about the nature of our universe," Tigner said. "Since then the international science community has developed two different technologies, each capable of accelerating electrons and positrons to record energies: superconducting radiofrequency cavities and room-temperature radiofrequency disks. The ITRP's decision was a difficult but necessary one. It opens the way for the world particle physics community to unite behind one technology and concentrate our combined resources on the design of a superconducting-technology linear collider."

Jonathan Dorfan, chair of the International Committee for Future Accelerators, of which the ILCSC is a subcommittee, expressed appreciation to the panel on behalf of ICFA members.

"The ITRP held meetings in Europe, Asia and the United States," Dorfan said. "They received presentations and input from all of the world's particle physics laboratories, from accelerator experts, and from particle physicists from many nations. Their work represents the recognition of the need to choose a single technology to allow the world particle physics community to proceed cooperatively to a final design. There will be many other issues to resolve before a construction decision can be made, including the choice of a site and the mechanism for international funding, but the ITRP's decision provides a solid basis for moving forward."

Scientists from throughout the worldwide particle physics community have endorsed an electron-positron linear collider as the next high-energy particle accelerator. In 2007, operations will begin at the Large Hadron Collider, now under construction at CERN, the European Organization for Nuclear Research, in Geneva, Switzerland. The LHC, a circular proton-proton synchrotron, will operate at the highest energies any particle accelerator has ever achieved. Together with the LHC, physicists say, the International Linear Collider would be able to address the 21st-century agenda of compelling questions about dark matter, the existence of extra dimensions and the fundamental nature of matter, energy, space and time.

CERN Director General Robert Aymar commented on progress toward an international linear collider design.

"A linear collider is the logical next step to complement the discoveries that will be made at the LHC," Aymar said. "The technology choice is an important step in the path towards an efficient development of the international TeV linear collider design, in which CERN will participate."

Hirotaka Sugawara, former director of Japan's KEK laboratory, also an ITRP member, described the science opportunities that a linear collider could provide.

"High energy physics has a long history of using proton and electron machines in a complementary way," Sugarawa said. "With concurrent operation, here is a remarkable opportunity to maximize the science from both a linear collider and the Large Hadron Collider. Exciting physics at the linear collider would start with the detailed study of the Higgs particle. But this would be just the beginning. We anticipate that some of the tantalizing superparticles will be within the range of discovery, opening the door to an understanding of one of the great mysteries of the universe—dark matter. We may also be able to probe extra space-time dimensions, which have so far eluded us."

Scientists and engineers from universities and particle physics laboratories have worked on the warm and cold technologies in recent years. Much of the work on the superconducting technology has been carried out by the TESLA Collaboration centered at the Deutsches Elektronen-Synchrotron, or DESY laboratory, in Hamburg, Germany. Scientists at Stanford Linear Accelerator Center, in California, and at KEK Laboratory in Tsukuba, Japan, have led the effort to develop the warm technology.

"This decision is a significant step to bring the linear collider project forward," KEK's Director General Yoji Totsuka said. "The Japanese high-energy community welcomes the decision and looks forward to participating in the truly global project."

Scientific discovery is the goal, SLAC Director Dorfan emphasized.

"Getting to the physics is the priority," Dorfan said. "The panel was presented with two viable technologies. We at SLAC embrace the decision and look forward to working with our international partners."

DESY Director Albrecht Wagner cited the achievement of an important milestone.

"With this decision," Wagner said, "particle physics has made a major step forward toward the future. The worldwide community of particle physicists can be proud that one of the two viable technologies has now been selected for the design of this global project, independent of its final location."

Hesheng Chen, director of the Institute of High Energy Physics, Beijing, welcomed this decision.

"Asian particle physicists believe that the linear collider is the next-generation high-energy accelerator to meet the great challenges in twenty-first century high-energy physics and are willing to make an important contribution to the international project," Chen said.

Michael Witherell, director of Fermi National Accelerator Laboratory, where scientists have worked on both warm and cold technologies, described the path ahead in the development of the linear collider design.

"With the technology decision behind us," Witherell said, "the particle physics community can now begin work on a global design for a linear collider. At the same time, science funding agencies from nations in Europe and Asia, along with the U.S. and others, must reach agreement on the mechanisms for funding and operating a truly global accelerator somewhere in the world. There are many steps ahead of us before an international linear collider becomes a reality, but today's announcement of the technology choice provides an important focus."

--ICFA--

http://www.interactions.org/linearcollider/

http://www.fnal.gov/directorate/icfa/International_ILCSC.html

http://www.ligo.caltech.edu/~donna/ITRP_Home.htm

Images available at http://www.interactions.org/icfa_announcement/images

Executive summary of ITRP Report at
http://www.interactions.org/pdf/ITRPexec.pdf (pdf file)

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INTERACTION POINT
September 3, 2004

Unity in Beijing: The Global Nature of Particle Physics Communication

By Neil Calder

It was 10 p.m. on Thursday in California, midnight on Thursday in Chicago, 7 a.m. on Friday in Europe, 2 p.m. on Friday in Japan and 1 p.m. on Friday, August 19, in Beijing when Jonathan Dorfan stood up to announce the recommendation of the International Technology Recommendation Panel at the ICHEP conference. In a breathless hush, 700 physicists assembled in the huge conference auditorium as well as the whole world's particle physics community were waiting.

The subsequent Press Release, issued within minutes on Interactions.org and the SLAC Web site, was something new. A major announcement about a proposed accelerator coming not from a single laboratory, as has always been the case, but a joint statement issued by the International Committee for Future Accelerators (ICFA), with expressions of support from the directors of five world labs.

With this release, high energy physics communication has moved on from the traditional model of individual labs working independently, to a unified statement speaking for all.

At the press conference following the announcement, five lab directors—Robert Aymar (CERN), Jonathan Dorfan (SLAC), Yoji Totsuka (KEK), Albrecht Wagner (DESY) and Mike Witherell (FNAL)—all expressed the same determination to move ahead with the design of the International Linear Collider.

Never before had world particle physics spoken to the press with one voice. A new unity had been forged.

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SPEAR3 Project Wins DOE Award for Excellence

By Keith Hodgson and Nina Stolar

On August 13, Secretary of Energy Spencer Abraham presented the Secretary's Excellence in Acquisition Award to the SPEAR3 Management team in a ceremony at the DOE headquarters in Washington, DC. The Fourth Annual DOE Project Management Awards pay tribute to those teams or individuals who have achieved outstanding results through resourceful, innovative thinking and implementation.

The SPEAR3 Management Team and Hanley Lee (DOE Stanford Site Office) received the Secretary's Excellence in Acquisition Award. Shown (l to r): Secretary of Energy Spencer Abraham, Hanley Lee, Richard Boyce, Bob He►el (ASD), Tom Elioff and Deputy Secretary of Energy Kyle McSlarrow. (Photo by Keith Hodgson)

The $58M, 3-GeV SPEAR3 accelerator—jointly funded by DOE and the National Institutes of Health (NIT)—is now providing 3rd generation light source capability for the SSRL user community.

Completed in November 2003, the SPEAR3 Upgrade Project replaced the original 30-year-old SPEAR storage ring with an entirely new low-emittance, high-current ring.

Following an intense 7-month shutdown period, the first electron beams circulated in the new SPEAR3 ring in mid-December 2003 and the first experiments began in mid-March. At the end of the first user run (July 31), the new accelerator had exceeded all expectations in performance—delivering 97.1 percent of the scheduled beam to users.

Tom Elioff, SPEAR3 Project Director, reflected on the evolution of the project and its aggressive installation schedule. He noted that at the beginning of the project, the SPEAR2 users and the SSRL Users' Organization Executive Committee welcomed the possibility of the enhanced SPEAR3 performance but were not enthusiastic about a major interruption in their research programs.

Richard M. Boyce (ASD), responsible for acquisition and installation of the magnets and supports, said, "The entire SPEAR3 project team deserves credit for the successful culmination of four years of intense effort and dedication which resulted in the remarkable accomplishment of meeting the extremely tight installation schedule and exceeding our first beam-to-users goal."

"SPEAR3 is a remarkable resource that will enable state-of-the-art science in numerous fields," said SSRL Director Keith Hodgson. "The $58 million project was completed on time and on budget. I thank the people whose extraordinary teamwork made the project successful. In a remarkable accomplishment, the old accelerator was dismantled, a new tunnel floor poured, SPEAR3 installed and commissioned, and users back on-line—all within a mere 11 months."

SPEAR3 incorporates the latest technology—much of it pioneered at SSRL and SLAC—to make it competitive with the best synchrotron sources in the world.

In late January Secretary Abraham observed, "This is the first time the Department of Energy and the National Institutes of Health have joined in funding an accelerator research facility. I expect this to be a long and productive collaboration whose impact will be truly far-reaching, generating new knowledge and benefits to humanity."

For more information on the SPEAR3 award and the Upgrade Project, see: http://www-ssrl.slac.stanford.edu/acquisitionaward.html

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By Shawne Neeper

The 2004 SLAC Summer Institute (SSI) bubbled with the vitality of a new, topic-a-day format that brought textbook learning directly alongside cutting-edge research. Themed on Nature's Greatest Puzzles, SSI opened on August 2 with the first puzzle: dark matter. In each of the nine weekdays that followed, SSI's 332 participants explored another Great Puzzle from the ground up.

Shown (left to right): SSI Coordinator Ellie Lwin (COM) enjoys Hawaiian night with costume contest runner-up Louise Riofrio (San Francisco State), winner Philip Amanik (UC San Diego) and SSI Program Director Charles Prescott (EA). (Photo by JoAnne Hewett)

Each day began with three, one-hour talks covering background and current understanding in one of the 10 puzzles. After lunch, students returned to Panofsky Auditorium to hear researchers from around the world report their latest advances on the puzzle of the day.

SSI Program Directors JoAnne Hewett (THP), Tuneyoshi Kamae (GLAST), John Jaros (EA) and Charles Prescott (EA) had been working since September 2003 to plan this year's program. "Student reactions have been very positive," Hewett said. "They liked hearing in the afternoon how questions from the morning talks are being answered by experiment."

The topical organization—in contrast to the traditional SSI division between lectures for seven days and conference presentations for the final two and a half days—was a boon for scientists interested in attending SSI a la carte. "Students can stay for two weeks and get the entire scope," said Kamae. "Those who are interested in a smaller set [of topics] can come and listen to those particular days."

"This was a brilliant idea," said David Leith (EB), who helped launch the SSI with Sid Drell (DO) in 1973 and served as a Program Director through 1997. "I think that the magic was in a format change that brought a mix of scientific interests in the attendees and allowed a very interesting coherence between the school lectures and the experiments… All the people who worked on it should be told how good it was."

Behind the Scenes

"It was really gratifying to see that the hard work we put into vitalizing SSI paid off," said SLAC Conference Coordinator Maura Chatwell (COM), who works year-round to arrange SSI registration and logistics. Each summer, Chatwell, SSI Coordinator Ellie Lwin (COM) and a cadre of summer student assistants go full steam to provide smooth operations for two weeks of talks, tours (this year to SLAC, Stanford and Lick Observatory), food and mingling.

This was summer student John McLaughlin's (COM) forth year helping Chatwell with SSI nuts and bolts, in particular getting lecture notes from speakers to students and posting information—including videos of the talks—on the Web (http://www-conf.slac.stanford.edu/ssi/2004/Default.htm). "It was a challenge to be able to deal with more speakers," Chatwell said. "We usually have about 35 per year. This year we had 54."

SSI students enjoy the California sunshine. (Photo by Harvey Lynch)

SSI 2004 required some 16-hour days, from morning set up at the Auditorium to late-evening take down after social hours, and the hard work paid off.

All Work and Lots of Play

When asked on the SSI feedback form what they liked best about this year's experience, responders most often mentioned the interweaving of theory and research, and social gatherings that fostered discussion.

"We kept them busy every night," said Hewett. Selected attendees presented their own thesis work during two evening poster sessions. Other nights, attendees converged outside Panofsky Auditorium for snacks and drinks, joined the annual SLAC versus SSI soccer game (which was won by SSI 4 to 3) and gathered at one of three themed dinners.

"By far the most popular was Hawaiian Night," Hewett said, "when we gave out prizes for the best costumes." A first prize basket of goodies went to UC San Diego graduate student Philip Amanik for his grass skirt and coconut bikini top.

Attendees indicated that conversation at the gatherings helped them to assimilate the day's exploration of a great puzzle. As one SSI student wrote, "It was good to have some theoretical and some experimental talks… and the microbrew beer was a great idea!"

QUOTES FROM SSI:

All our friends who came from Japan and Europe were very, very pleased with this format.

—Tuneyoshi Kamae

We felt that we injected good excitement and enthusiasm into social hours and dinners, which resulted in the physicists really interacting with each other and having fun.

—Maura Chatwell

Many participants expressed appreciation for the new format. Going into the SSI, we didn't know how well that would go over, but I think we will have to keep that change in future years. It was a big success.

—Charles Prescott

Nima [Arkani-Hamad (Harvard University)] ended the SSI with his usual flourish. He challenged the audience to solve one of nature's greatest puzzles by turning our standard assumptions upside down and backwards, so they fit just so. Bravo!

—John Jaros

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Meson Visualizations: A Collaboration of Art and Physics

By Shawne Neeper

How would neutron decay look at human scale and in full Technicolor? From September 9 to October 1, the halls of the Research Office Building (ROB, Bldg. 48) will come alive with visualizations of quantum phenomena from standard-model collisions to particle-wave duality.

Dawn Meson's painting entitled Collision II is based on the standard model description of a two-particle collision. (Photo courtesy of

The exhibit marks the debut of artist Dawn Meson's body of work entitled Sum over Histories. In these paintings, Meson uses color, translucency, texture and shape to represent the tiny, invisible interactions that pervade our everyday world.

"One of the things that attracted me to quantum physics in particular," Meson said, "was that our instruments can only see things down to a certain granularity and then it becomes a theoretical exercise. As an artist, that's interesting because these are part of our natural world that can't be captured by photography."

In the painting entitled Particle Wave, different colors and opacities symbolize the levels of probability for 'where' in quantum dimensions a particle lies. Another piece, called Collision, visualizes the interactions of subatomic particles from a two-particle collision as described in the standard model.

Time-lapse videos will appear alongside the paintings. Each stop-action sequence—often including the artist, brush in hand—shows steps in a painting's evolution that reflect Meson's interpretation of stages in her quantum subject over time.

The Sum over Histories exhibit is an adventure away from more literal paintings and drawings Meson has done in recent years. She said the work doesn't try for realism, but

- The Role of SLAC Citizen Committees in ES&H
- SULI Students Celebrate a Summer of Physics
- Next Ashley Fellow Announced
- TRAFFIC TIPS
- Stretch Break Exercise Software Now Available
- The Role of the Employee in ES&H
- Sand Hill Review Available—Take a Literary Breather!
- Milestones

EVENTS

- Get Ready for SLAC Family Day: Our Universe, Large & Small
- Biggest Kids Day Yet a Roaring Success
- Give Blood Today, Save A Life Tomorrow
- Upcoming Events

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Dawn Meson)

instead aims to engage the visual imagination. "Imagination has a very large role in the discovery and advancement of particle physics," Meson said, "and I think that's something that art can speak to in some small way."

Cosmologist Influences Artistic Mind

Meson said her own imaginings of quantum events were influenced in great part by conversations with SLAC cosmologist Stephon Alexander (THP). Shortly after she began work on Sum over Histories, Meson met Alexander at Farley's coffee shop in the Potrero Hill district of San Francisco. "I was doing some kind of calculation or something and [Meson] noticed it," Alexander said. "We got into a conversation and a couple hours later… we established a working friendship." Over the months to come, Alexander and Meson would meet to discuss the exercises in math and visualization that define Alexander's work process. "We got very far into the physics," Alexander said. "She has an exceptional ability to assimilate the mathematical concepts that I can't really explain with words."

Meson at work in her studio. The Sum of Histories Exhibit will run from September 9 to October 1 in the ROB, Bldg. 48. (Photo courtesy of Dawn Meson)

Public Reception on September 9

Meson's take on those concepts will debut in a public reception September 9 from 6:00 to 8:00 p.m., in the ROB, which seems the ideal setting to showcase images of quantum physics. Its corridors and galleries provide appropriate viewing space, while its offices house a ready audience of particle physicists. Building manager Harvey Lynch (BABAR) toured ROB's hallways with Meson to plan the exhibit. Meson took photos of the best sites, then used Photoshop to paste in the paintings. "I've taken that to the craft shop, to come up with a scheme to hang them," Lynch said. "We're set to move ahead."

Meson's Web site previews Sum over Histories and other collections. Visit: http://www.dawnmeson.com

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By Heather Rock Woods

Thermal oxide is the real on-off switch for your computer. The nanometers-thick film on the surface of silicon transistors helps turn on and off the flow of electricity through the transistor, providing the 0 and 1 binary signals modern electronics run on. There are several million transistors on each computer chip.

As technology produces smaller chips that require thinner oxides, the ability of thermal oxide to act as the basis for integrated circuits is starting to break down.

"We're pushing the fundamental limits," said materials researcher Sean Brennan (ESRD). "Anything you can do to learn more about the thermal oxide is a huge plus."

Thermal oxide is 'grown' on the surface of silicon wafers by diffusing oxygen atoms into the silicon's crystal lattice. The oxygen atoms break silicon-silicon bonds and form silicon-oxygen bonds, in the process disrupting the perfectly repeated and regular crystal structure. This layer of oxidized silicon (SiO2) is thermal oxide, and was long believed to be completely amorphous, in other words, an unpredictable structure without long-range order.

New evidence from Brennan and former SSRL graduate student Anneli Munkholm, now at Lumileds Lighting, is overturning that assumption. Their research, recently published in Physical Review Letters, shows that thermal oxide holds "weak crystalline 'echoes' of the silicon's former self buried within the non-crystalline oxide," said Munkholm.

X-ray scattering at SSRL revealed that thermal oxide has faint memories of the former position of the silicon atoms. Each silicon chip is a single crystal, meaning it follows a regular three-dimensional pattern. Think of a three-dimensional chess board—all the black squares are in predictable locations (forward 1, over 1, up 1). In contrast, in thermal oxide the oxygen atoms randomly attaches to

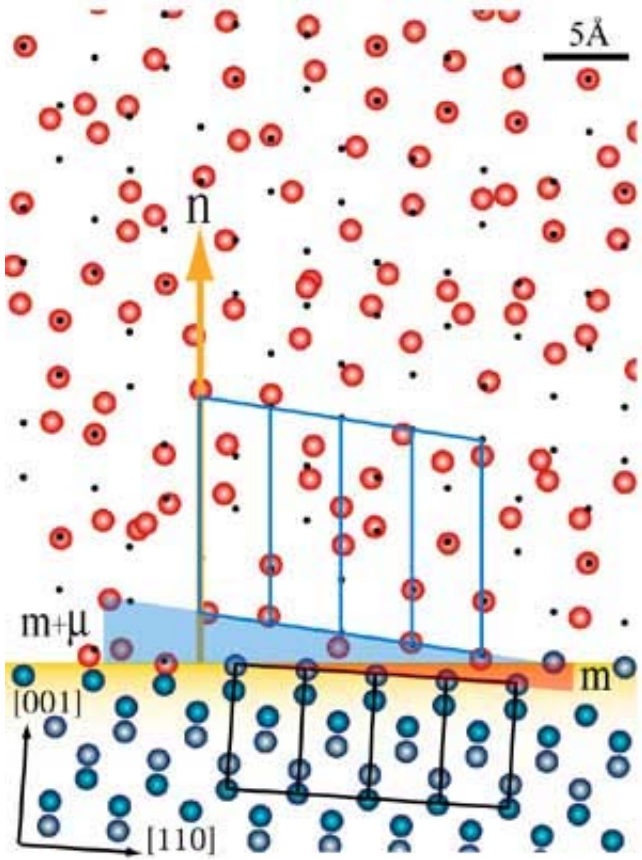

Illustration of the silicon atom positions near the interface (the horizontal line) of crystalline silicon and amorphous thermal oxide (SiO2) for a crystal structure. The small dots in the thermal oxide (above the

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silicon in any direction, so the structure is not a crystal.

So Munkholm and Brennan were surprised to find their scattering patterns show the silicon atoms are relatively close to the positions they held before being disrupted by oxidation. The new model based on the data also shows that the crystal memory is stronger closer to the pure silicon (at the interface between the silicon and thermal oxide, where oxygen atoms are less dense), and fades closer to the surface of the thermal oxide. The silicon lattice also expands as oxygen diffuses in, but expands less at the interface.

horizontal line) represent where the silicon atoms would be if the crystal structure had expanded without disordering. The outline of the four silicon unit cells is shown below the interface. The outline of four expanded lattice cells in the oxide is shown above the interface. (Graphic courtesy of SSRL)

"It is only through the use of an intense synchrotron x-ray beam from SPEAR that we were able to observe the residual order," Munkholm said.

They found residual order in a wide range of oxidation recipes with oxide thicknesses from 6 nanometers (nm) up to 100 nm and on silicon with different surface orientations (the crystal sliced at different angles).

"We have seen evidence that different recipes result in different amounts of disorder," Brennan said.

This suggests researchers may be able to relate certain amounts of order with specific electrical properties in thermal oxide that could be better for running new integrated circuits.

For more information, see: http://www-ssrl.slac.stanford.edu/research/highlights_archive/oxidizedsi.html

INTERACTION POINT
September 3, 2004

The Role of SLAC Citizen Committees in ES&H

By Mike Grissom

For many years now the SLAC citizen committees have been an integral part of environment, safety, and health (ES&H) at SLAC. As director emeritus Burton Richter said:

From the earliest days of the Laboratory, the citizen committees have been an essential part of the SLAC safety program and have contributed enormously to making SLAC a safe place to work. The success of these committees arises from the fact that their membership includes people from different areas of the Laboratory with various technical backgrounds, bringing a broad range of perspectives and expertise to addressing problems. I regard such committee service as a very important part of the work of members of the SLAC staff.

Frank O'Neill, Chair of the Fire Protection Safety Committee (Photo by Diana Rogers)

These thoughts continue to resonate with Director Jonathan Dorfan, who appoints citizen committee members. (The terms are generally three years for members and five for chairpersons.)

Although citizen committees often deal with routine issues, one of their major responsibilities is to ensure new projects are completed safely and in compliance with established requirements and standards. An outstanding example of this process was the commissioning and delivery of the first beam at SPEAR3 in December 2003. During the more than six-month down for SPEAR in 2003, and for some years prior to the SPEAR2 ring decommissioning and SPEAR3 commissioning, an extensive series of citizen committee reviews took place, helping to ensure the safe and timely completion of the project.

This process of reviewing each of the major accelerator systems, a key component of SLAC's Integrated Safety Management System (ISMS), will be further exercised over the next few years as the Linac Coherent Light Source (LCLS) moves through planning and construction towards commissioning in 2009.

What the Committees Do

As described in the SLAC ES&H Manual, Chapter 31, the citizen committees are expected to:

• Assist personnel in evaluating hazards

• Inspect operations and projects

• Interpret industry standards

- Recommend appropriate procedures and policies
- Review accelerator facility procedures and safety training programs
- Verify that design processes comply with safety regulations

For new projects the process is coordinated through the Safety Overview Committee (SOC), chaired by Ken Moffeit (EA). The SOC is composed of the chairpersons of all the citizen committees, the OSC chair and an ES&H member. For details on the charters of citizen committees, see: www-group.slac.stanford.edu/esh/eshmanual/ESHch31.pdf.

Perry Anthony, Chairperson of the Electrical Safety Committee (Photo by Diana Rogers)

Interacting with Committees

The designated project manager or experiment spokesperson normally starts the process of citizen committee review by contacting the chair of the SOC. The project manager or principal investigator for smaller projects can contact specific citizen committees directly, but more often this is done by the relevant ES&H coordinator, such as Ian Evans at SSRL. John Galayda, recently appointed associate director for the new LCLS Division, had already participated in the review process with presentations to the SOC and specific interactions with relevant citizen committees during the design phase of LCLS.

Citizen Committees and Chairs

- Safety Overview Committee (SOC), Ken Moffeit, Ext. 2772
- As Low As Reasonably Achievable Committee (ALARA), Dieter Walz, Ext. 2786
- Earthquake Safety Committee (EqSC), Scott DeBarger, Ext. 4647
- Electrical Safety Committee (ESC), Perry Anthony, Ext. 4354
- Environmental Safety Committee (EnvSC), Bill Kroutil, Ext. 4785
- Fire Protection Safety Committee (FPSC), Frank O'Neill, Ext. 5300
- Hazardous Experimental Equipment Committee (HEEC), John Weisend, Ext. 5448
- Hoisting and Rigging Safety Committee (H&RSC), Dave Ernst, Ext. 8346
- Non-ionizing Radiation Safety Committee (NIRSC), Ron Koontz, Ext. 2528
- Radiation Safety Committee (RSC), Harvey Lynch, Ext. 3691

There are other ES&H-related committees that are not chartered as citizen committees but are nevertheless important parts of the SLAC ISMS program. These include the ES&H Coordinating Council (ES&HCC), the Operating Safety Committee (OSC) and the Local Safety Committee (LSC).

For further information on ES&H-related committees, see:
http://www-group.slac.stanford.edu/esh/committees/

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Last update Friday September 03, 2004 by Emily Ball

INTERACTION POINT
September 3, 2004

SULI Students Celebrate a Summer of Physics

By Shawne Neeper

SLAC students in the DOE's Summer Undergraduate Laboratory Internship (SULI) program celebrated the close of their eight-week experience in hands-on research with hamburgers and sunshine at the Sector 6 picnic area on August 13. The 25 physics and engineering undergraduates received their SULI certificates with a word and a handshake. Each took a photo with his or her SLAC mentor, to commemorate a summer filled with scientific and social adventures.

The luncheon concluded with the presentation of the 10th annual Ernest Coleman Award for Scholarship and Citizenship. The award is named for SLAC physicist Ernest Coleman, who helped develop the SLAC Summer Science Program—a predecessor to SULI—to encourage minority and less-advantaged students to pursue science careers. This year's interns nominated their peer Kevin Reynolds, for his enthusiasm and hard work with his mentor, x-ray spectroscopist Uwe Bergmann (SSRL).

SULI interns (left to right) Joseph Piacentine, Kevin Reynolds and Rebekah Schiller with SULI Program Director Roberto Vega. (Photo by Diana Rogers)

To help Bergmann evaluate new equipment from different vendors, Reynolds set up lasers and performed experiments comparing spectrograph mirrors on the SSRL floor. The mirrors will be used in novel x-ray techniques to study light elements including water and protein catalysts. "It was extremely useful," Bergmann said. "We have now made a large order of mirrors based on his analysis." This fall, Reynolds is entering his sophomore year at Norfolk University.

Reynolds and the other students presented their projects as papers and 20-minute talks, in the days leading up to their closing picnic.

"This year's students really got to work fast, and seemed to get a lot out of their summer here," said SULI Program Manager Helen Quinn (THP). "About half of them were able to stay on an extra week after the official program end, a possibility we have been able to offer only in the last two years. The program is all too short for most projects, so the extra week is appreciated by both students and mentors."

During their stay at SLAC, the students lived in a cooperative house on Stanford University's fraternity row with SULI Program Director Roberto Vega (THP). On summer leave from Southern Methodist University

in Dallas, Vega pursued Higgs phenomenology by day and addressed student needs—from fielding physics questions to promoting kitchen clean up—by night.

Shown left to right: Roberto Vega (THP) and Jonathan Dorfan (DO) present SULI intern Kevin Reynolds with the Ernest Coleman award. (Photo by Diana Rogers)

"It's fun," Vega said. "It's challenging." He arranged talks by SLAC physicists each week, and organized SULI field trips to Lick Observatory, the Stanford Medical School MRI facility and the Stanford physics department. He also encouraged an informal SULI social calendar of impromptu outings to local salsa clubs and weekend climbing expeditions.

The SULI program provides science and engineering internship opportunities at twelve DOE facilities. A tour last summer made SLAC the first choice of 27-year old Chico State University senior Joe Piacentine (KIPAC). "I wanted to explore what graduate school might be like," he said, "and explore astrophysics or particle physics." This summer, Piacentine learned to use custom software to analyze the telescope data for objects that had not been seen before, and ascertain which were likely to be clusters of galaxies.

"This has really gotten me excited about going to graduate school," said Rebekah Schiller (SCS), who will be a senior at Oglethorpe University this fall. During a SULI field trip to the Stanford University physics department, Schiller accepted an invitation to share a day in the life of a physics graduate student. She spent a day learning about a thesis project and helped solder research equipment.

The SULI interns have now returned to their colleges, hopefully with new inspiration and aspirations.

For more information on the program, see: http://www.slac.stanford.edu/gen/edu/undergraduate.html

INTERACTION POINT
September 3, 2004

Next Ashley Fellow Announced

By Davide Castelvecchi

Arturo Alarcon (AD) won the Alonzo W. Ashley Career Development Fellowship, which will enable him to go back to school this fall to pursue his career goals.

Arturo Alarcon will take time off to pursue his career goals. (Photo courtesy of SLAC)

For the past three years Alarcon has been an operator at the Main Control Center (MCC), helping deliver the linac's beam for the PEP-II rings and other uses. "The machine is very complex and has lots of subsystems," he said. Finessing the beam's quality poses constant challenges. "It's problem-solving heaven."

Alarcon will now get a year off to take programming classes at Foothill College, leading to an Associate Degree in software development, and will train in MCC to step up to a level-3 operator. With the additional training, he will be able to take on added responsibilities with the MCC.

Alarcon will also help compile a Klystron User Guide, a reference for current and future MCC operators. In the spring he hopes to collaborate on a software project in the Technical Division during his fellowship leave.

About the Fellowship

The Ashley Fellowship was established in 1999 in honor of Alonzo W. Ashley, who promoted diversity and encouraged career development during his 30 years at SLAC. The fellowship is awarded to employees who have demonstrated contributions to diversity at SLAC or in the community. Applicants submit a detailed proposal of how they plan to spend their time off in a way that will develop their career while contributing to the SLAC mission.

The fellowship gives up to a year of part-time or full-time release from one's duties, and provides the employee's department with funding for hiring a temporary replacement.

Past Recipients

William Colocho (AD), Nick Arias (NLC) and Pauline Wethington (COM) were past Ashley fellows, and Lesley Wolf (TIS) is the current recipient. During her fellowship, which will be up next month, Wolf pursued several projects in library management and outreach to school teachers.

"It takes a lot of openness to take a good employee and let them take a year off their work. It's quite a privilege," Wolf says. "But in the end, I think the Ashley Fellowship makes better employees."

For information on the Ashley Fellowship, see: http://www-group.slac.stanford.edu/hr/er/fellowship/2004/ashley.html

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Last update Thursday September 02, 2004 by Emily Ball

INTERACTION POINT
September 3, 2004

TRAFFIC TIPS

By Rick Yeager

All SLAC employees, users and contractors…

Please remember that you have a responsibility to operate vehicles safely on site. The Rules of the Road spelled out in the California Department of Motor Vehicles (DMV) Vehicle Code apply at SLAC. Your individual compliance will ensure the safety of all persons on site.

GSA Operating Instructions

The General Services Administration (GSA) owns the SLAC vehicle fleet, and publishes operating instructions that SLAC is required to follow. The first regulation covers the mandatory wearing of seat belts in vehicles that are equipped with them. The second one covers the mandatory no smoking requirement in government vehicles. The third covers the prohibition of personal use of a government vehicle. There are no exceptions to these regulations and all operators of GSA vehicles should follow them. The regulations may be viewed on-line at: http://www.gsa.gov

Electric Carts

Operators of electric carts which do not have turn signals and stop lights are required to display DMV-approved hand signals for turning, changing lanes or stopping. If an electric cart is moving slowly due to low battery power or heavy load, the operator should move to the extreme right side of the roadway and signal any following motor vehicles to pass when it is safe to do so.

Check for more traffic safety tips in the next Interaction Point!

INTERACTION POINT
September 3, 2004

Stretch Break Exercise Software Now Available

By Linda DuShane White

'Stretch Break' is a new software program available to staff who have windows computers. Maria G. Gherman, M.D., MPH of the ES&H/SLAC Medical Department recommended the program as a means to prevent repetitive stress injuries.

This program is SLAC-licensed for use on SLAC computers. It installs software onto your computer that pops up at pre-programmed times (for instance, every 15 minutes, or 30 minutes, or an hour—your choice) and reminds you to take a quick break and stretch. If you select the 'stretch now' option, it guides you through a few simple exercises that are ergonomically selected to help in reducing computer stress.

For more information, see: http://www-group.slac.stanford.edu/esh/medical/ergo.html#stretching

This screenshot shows a typical stretch from the program. (Image courtesy of Larissa Williams)

INTERACTION POINT
September 3, 2004

The Role of the Employee in ES&H

By Mike Grissom

"Responsibility for promoting and maintaining a safe and healthy workplace and for protection of the natural environment rests with every individual who works on the SLAC site." —Burton Richter

Employees and subcontractors may need a variety of PPE in the course of their work. (Photo courtesy of Jack Fry)

This quote is a timely reminder given accident rates have been rising. Here are three things all of us should do every day to meet this challenge.

Be Aware of Work Hazards

Be aware of hazards related to your work. John Turek, Industrial Safety Engineer (SHA), suggests the following simple steps:

1. Think about the work you are about to do.

2. Decide if it is safe. If not, then stop. Rethink what you are doing so it can be done safely, then go ahead.

3. If you are not sure if you can proceed safely, ask for help. Your supervisor, department head, associate director, and the experts at ES&H can all help make your work and life at SLAC safer.

Take Advantage of Job-Focused Information

As a part of the Lab's on-going efforts to reduce accidents and injuries, a variety of information has been prepared specific to different kinds of jobs:

1. Office Workers. People working mainly at desks throughout the day tend to have injuries and accidents such as repetitive stress or back injuries. See the Medical website for information on ergonomics: http://www-group.slac.stanford.edu/esh/medical/

2. Researchers. Researchers tend to have both general accidents (back injuries) and ones specific to their fields, for instance chemical burns or electrical shocks. Pay special attention to using the personal protective equipment (PPE) specific to your field. See: http://www.slac.stanford.edu/esh/forms/ppehaz.pdf

3. Industrial Workers. People in industrial jobs such as machinists and carpenters tend to have accidents involving equipment specific to their field, in addition to general injuries such as back strain. Pay special attention to using equipment properly and following approved procedures, and using the right PPE for your work. See the Job Hazard Analysis and Mitigation process: https://www-internal.slac.stanford.edu/esh/SLACsafety/jham/

Remember Your Responsibility for Safety

At times we all can feel rushed in our work or not foresee every possible hazard. That is when we need to look out for one another. Remember that if you see someone working unsafely, you have both the duty and authority to stop them, respectfully, in order to avoid or prevent an accident. The bottom line is each of us is responsible for our own safety as employees at SLAC.

Future TIP articles will provide details about how individuals can participate in specific programs, for example the SLAC Integrated Safety Management System (ISMS). Details about the program are available on the Web: www.slac.stanford.edu/esh/isms/

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Last update Friday September 03, 2004 by Emily Ball

INTERACTION POINT
September 3, 2004

Sand Hill Review Available—Take a Literary Breather!

Copies of the Spring Sand Hill Review are now available from Marty Sorensen (ACC) or Janice Dabney (TD) for $6 (funds go toward next issue).

A poem from the Review is excerpted at right.

The work is available on-line at: http://www.stanford.edu/~sandhill/2004May/index.htm

Not a sound

Not a sound!
Dark, cold, and quiet
My cat lifts his head
begging me with his eyes
Stop fidgeting; I'm trying to sleep
He turns around once, steers again and curls up into a ball
I lay still
He looks so peaceful
Is he dreaming?
Is he dreaming about today, yesterday, last month,
any time at all?
Or just remembering images?
I think about images
Not today, yesterday, or the times gone by
Only images
I lay awake
Not a sound!

—Ziba Mahdavi

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September 3, 2004

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MILESTONES

Award

Bjorken, James (THP), 2004 Dirac Medal, Awarded by Abdus Salam International Centre for Theoretical Physics (ICTP), on August 8. For more information, see: http://www.ictp.trieste.it/~pio/Dirac_04.html

Service Awards

5 Years

Grossman, Yuval (THP), 9/1
Jenks, Stephen (ESD), 9/7
Kachru, Shamit (THP), 9/1
Lowe, Cindy (NLC), 9/1
Saenz, David (LCLS), 9/13
Shakhnovsky, Oleg (ESD), 9/7

10 Years

Bense, Booker (SCS), 9/6
Copeland, Michael (MD), 9/16
Galetto, Thomas (AD), 9/12
Garriz, Patricia (EP), 9/12

15 Years

Chan, Kingston (SEM), 9/11
Remerata, Eulinia (ACC), 9/1

35 Years

Tilghman Jr., Anthony (ESD), 9/15

To submit a Milestone, see:
http://www2.slac.stanford.edu/tip/milestonesubmissionguidelines.htm

See Awards and Honors at http://www.slac.stanford.edu/slac/award

INTERACTION POINT
September 3, 2004

Get Ready for SLAC Family Day: Our Universe, Large & Small

Saturday, September 18
11:00 a.m. – 3:00 p.m.

Everyone in the SLAC Community is invited! Please use Web form for lunch reservations, activity sign ups and to pre-order t-shirts.

Preliminary Program Highlights

ENTERTAINMENT, MUSIC AND MORE ON CENTER STAGE

Welcome: SLAC Director Jonathan Dorfan

DJ Eddie McGee (RP): Music for dancing and zany entertainment

Nocturnal: Live music with Tom Anzur (SSRL)

Star Search: Individuals and groups compete in a talent competition

The Seventh Season: Live music with Yuri Batygin (NLC)

FABULOUS FOOD FAIRWAY

Multiple food stations feature fabulous food. Try one booth, or stop by all of them!

Andromeda Station—BBQ: Angus Beef Hamburgers, Vegetarian Boca Burgers & Hot Dog Bar, Ranch Style Beans with Chipolte, Yukon Gold Potato Salad, Roasted Corn on the Cob, Cole Slaw and Watermelon

Cygnus-1 Station—Indian: Tikka Chicken Skewers, Spinach Pakora with Indian Dipping Sauce

Vega Station—Asian: Kalbi BBQ Ribs, Asian Spring Rolls

Station Saturn—Mediterranean: Spanikopita, Hummus with Pita Chips

VOLLEYBALL TOURNAMENT

11:00 a.m. Sign up early with your friends and family. Novices are welcome, but medals not guaranteed!

2:30 p.m. Volleyball Championship Game on The Green

GAMES FOR KIDS OF ALL AGES!

Basketball Shoot: Free-throw shooting contest. Prizes, too!

Inflatable Giant Slide: This 22-foot tall plunge of fun will thrill every age.

Midway Games: Test your skills to win prizes playing Holy Roller, Frog Launch, Go Fish, Pit Stop, Goofy Golf, Punk Rocked and Flying Saucers

Krafts for Kids: Color, paste, assemble and create to your heart's content

Face Painting: Painted figures or fun temporary tattoos.

Storyteller: The kids will be fascinated by story adventures.

Casino Royale: Hit the jackpot! Roulette, Blackjack, Chuck-a-Luck & a Big 6 Wheel. Exchange casino chips for tickets for a chance to win a prize. Must be 18 years of age to enter.

Classic Cars: Head out to the Visitors' parking lot near the Main Gate to view classic cars.

Massage: Free short chair massage sessions with Mer Baldoza (ESD) Sign up early—limited availability!

PHYSICS IS FUN!

Science Talks and Demos

High Energy Physics—Martin Perl (Group E)

Synchrotron Radiation Research—Herman Winick (SSRL)

X-ray Astronomy—Ming Feng Gu (KIPAC)

Cryogenics Magic Show—John Weisend (EFD)

Physics Under Pressure—Michael 'MO' Olson (St. Norbert College)

Tesla Coil Demonstration—Hartmut Sadrozinski & Terry Schalk (UC Santa Cruz)

LABORATORY TOURS

Tours to visit Klystron Gallery and the GLAST LAT Lab.

For more information on SLAC Family Day 2004, see: http://www-project.slac.stanford.edu/familyday/

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Last update Wednesday September 01, 2004 by Emily Ball

INTERACTION POINT
September 3, 2004

Biggest Kids Day Yet a Roaring Success

By Teresa Troxel and Joni White

SLAC celebrated its third annual Kids Day on Thursday, August 19. This year, six more workshops, the heart and soul of the day, were added, bringing the number of workshops to 18. We reached full capacity, accommodating 234 children ages 9-16.

Photo courtesy of Lowell Klaisner

The program consisted of a welcome by Anahid Yeremian (ARDA), morning and afternoon workshops, a lunch and—after the ice cream social—a short science talk. All kids were given a safety presentation by Gene Holden (KM) before being turned over to their group leaders. Safety equipment such as glasses and ear plugs were provided. Volunteer escorts conducted groups of kids with schedules and maps in hand all over the SLAC site throughout the day.

Workshops were designed for two age groups (9-12 years and 13-16 years). In at least one workshop per group, the kids made something they could take home. Although most of the workshops were technology oriented, such as electronics, mechanics, welding and magnetics, many of the workshops were based on science including biology, astrophysics and waves.

Each workshop was developed by a workshop leader based on his or her job, who worked hard to design a program that explained their work in an interesting and appropriate way for the kids's age—and was down right fun. This year, Adele Panofsky (DO) led a special seminar about Paleontology. The kids got to dig for fossils in the sandstone hills by the Research Yard!

Much planning went into the afternoon science talk that was the grand finale to the day. Before trying to gather 234 tired kids into the Auditorium, we all relaxed together over ice cream. Then it was the task of Dr. Boom to lecture and demonstrate science in a fun and interesting way. "I thought it was great, and my boys were happy," said Paul Miller (AD). He added that the event was interesting and well organized.

Everyone is looking forward to Kids Day @ SLAC 2005 next summer!

INTERACTION POINT
September 3, 2004

Give Blood Today, Save A Life Tomorrow

The next SLAC blood drive is on Wednesday, October 13, from 8 a.m. to 3 p.m. in the Panofsky Auditorium Lobby.

http://www-group.slac.stanford.edu/hr/d/Blooddrive.html

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The Interaction Point

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