Dear SURF Readers,

Welcome to the October 2012 Sanford Underground Research Facility (SURF) monthly newsletter. In the coming months, this newsletter will be posted online, and a pdf copy will be available. You will also receive an email reminder every month providing the link to the newsletter and SURF news updates. We will still be glad to receive your input on news, links to news articles, upcoming workshops, conference notices, scientific updates, information concerning SURF, employment opportunities, and other highlights relevant to underground science.

Important Dates

October 30-November 1: LBNE CD-1 Review - Fermilab, Batavia, Illinois

December 14-16: LUX-ZEPLIN (LZ) meeting – Lead, South Dakota

DIANA Project update

The University of Notre Dame received a one-year, $1.6 million grant from the National Science Foundation to support the DIANA collaboration's continued research and development of its plans for an underground accelerator laboratory. DIANA--the Dual Ion Accelerators for Nuclear Astrophysics--would provide experimental facilities for the study of nuclear reactions that drive stellar burning and explosion, with production of elements heavier than iron. It would use two relatively small variable-energy particle accelerators: one at 30 to 400 keV, the other at 350 keV to 3 MeV, installed deep underground.

The grant allows the group to finalize the design and provide a budget baseline for the final NSF decision on funding and construction of the facility. SURF signed a subgrant agreement with UND to provide engineering and project management staff who will investigate the suitability of SURF as the site for the DIANA experiment. In addition to SURF, several other sites are under consideration. The South Dakota team will work on experiment design and plans for installation at the 3950 Level, where DIANA could be located (as shown in Figure 1). The 4850 Level is another possible location.

As part of the campaign to determine the suitability of the SURF site, researchers from the University of Notre Dame (UND) continue to take data on the 4100 Level to characterize the thermal and near-thermal neutron background there.

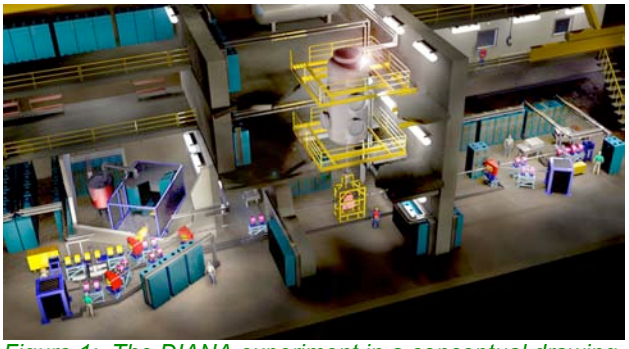

Figure 1: The DIANA experiment in a conceptual drawing. The facility could be located at SURF.

"The neutron background characterization by the Notre Dame group is going along very well," reports DIANA collaboration member Andreas Best. "We recently completed the measurement at the 4100 Level and moved the detectors to the WIPP site in southeastern New Mexico for flux comparisons. We are planning to ship the setup back to Homestake in December and deploy them either on the main 4850 Level or at a shallower depth to map out the influence of cosmic-ray absorption on the neutron background."

A preliminary analysis of the 4100 Level data shows a slightly higher (but still in the expected range) flux than at the Soudan and SURF laboratories; this is probably due to the exact location of the measurement as the detectors were situated in an airlock, closely surrounded by bare rock and concrete.

The DIANA collaboration consists of several institutions including University of Notre Dame, The University of North Carolina, Western Michigan University, and Lawrence Berkeley National Laboratory.

LUX-ZEPLIN (LZ) meeting

In mid-September, nearly 50 members of the LZ collaboration met at SURF in South Dakota (shown in Figure 2) to discuss plans for the next generation dark matter experiment and the technical challenges they face in undertaking this project. LUX is currently the world's largest dark matter detector of its type,

and is undergoing testing at the 4850 Level Davis campus. The detector will begin taking data later this year or in early 2012.

Figure 2: Members of the LZ collaboration gather in front of the Yates Shaft headframe in Lead, South Dakota

"The next generation of LUX--LUX-ZEPLIN (LZ)--with seven metric tons of xenon will be about twenty times larger and up to fifty times more sensitive than the current experiment," says Murdock Gilchriese, Deputy Operations Head for SURF at Lawrence Berkeley National Laboratory. The larger experiment will be more complex, and one of the first difficulties will be lowering the detector to its underground location. The design will be based on building the largest inner detector.

Gilchriese reported that another challenge will be in creating an internal electrical field powerful enough to operate a detector much larger than LUX, but carrying this out in a way that does not create spurious signals. LZ will also have to be more sensitive to background radiation coming from inside the detector, for example, from impurities in the liquid xenon, such as trace amounts of krypton. LUX will use xenon purified to a few parts per trillion, but LZ will have to reach "per parts quadrillion" purity, according to Gilchriese.

The National Science Foundation has approved a proposal for research and development, leading to a full proposal for LZ by this time next year. The Department of Energy is also considering an LZ proposal.

The LZ collaboration includes researchers from more than a dozen universities and laboratories in the United States as well as scientists from England, Scotland, and Portugal.

In Memoriam: Robert Wharton

Dr. Robert Wharton, President of South Dakota School of Mines & Technology passed away due to cancer treatment complications on September 19. Wharton began his tenure at the engineering school in July 2008. While there, he developed new graduate programs, including a doctoral degree in mechanical engineering, and substantially increased research funding.

Figure 3: School of Mines President Robert Wharton (middle) visits the 4850 Level Davis Campus in May 2012

Wharton served on the board of the South Dakota Science and Technology Authority, which oversees the operation of SURF. He was a strong advocate of underground science and the proposed scientific research at SURF, working closely in its development from the time of his arrival in South Dakota.

SURF Funding Transition

September 30 marked the last day of SURF (and DUSEL) funding by the National Science Foundation. The NSF funds allowed the project to get off the ground in 2007, and provided the resources necessary to create the "Preliminary Design Report." This extensive report covered all aspects of the project and the facility: Science, Engineering, Environment, Health and Safety, Cost and Schedule, and Education and Outreach. The report will be invaluable for future underground experiments to take place at SURF. The end of this phase of funding does not mark the end of our partnership with NSF, as the agency will support experiments, and various education and outreach efforts.

The Department of Energy, through Lawrence Berkeley National Laboratory (LBNL) is currently supporting SURF Operations. (Please note our new

address on Page 7.) Two reviews were conducted in August to ensure that Sanford Lab met with DOE standards for environment, health, and safety. Reviewers provided valuable feedback and gave Sanford Lab high marks for EHS programs already in place.

Kevin Lesko, Head of the LBNL Project Office for SURF, expressed thanks to South Dakota staff for all their hard work in keeping the Homestake viable and transitioning smoothly between the NSF and DOE stewardship.

SURF Newsletter Supplement Articles

The second in the series of SURF Newsletter Supplement articles, "The MAJORANA DEMONSTRATOR Project at the 4850 Level Davis Campus" is now available at:
http://www.dusel.org/html/early-science-progress.html

SURF IN THE NEWS

Symmetry.com: *Time projection chambers: a milestone in particle detector technology* *(Jessica Orwig, October 10)*
Researchers propose machine for a clean, mean neutrino beam (Kathryn Jepson, September 27)

Black Hills Pioneer: *Science through 2043* *(Wendy Pitlick, October 2)*
Scientists install dark matter detector underground *(*Wendy Pitlick, September 5)

Rapid City Journal: *Geological engineering student named Mines Medal Fellow* (September 23)
School of Mines loses its leader (September 20)
President of South Dakota School of Mines dies (September 19) (Also *Washington Examiner*, kotatv, *Capital Journal, APLU news*)
Astronomy Festival aims to turn eyes to the sky (August 17)

The Daily Republic: *Scientists in Lead make plans despite funding woes* (Wendy Pitlick, October 8)

For *twitter* updates see: www.sanfordlab.org

Recent Reports Available

Prepublication version of the report of the decadal study by the Committee on the Assessment and Outlook for Nuclear Physics (NP2010 Committee):
http://sites.nationalacademies.org/BPA/BPA_069589

The National Research Council report – "An Assessment of the Deep Underground Science and Engineering Laboratory":
http://www.nap.edu/catalog.php?record_id=13204

Marx-Reichanadter Committee report to DOE:
http://science.energy.gov/~/media/np/pdf/Review_of_Underground_Science_Report_Final.pdf

LBNE Reconfiguration Report:
http://www.fnal.gov/directorate/lbne_reconfiguration

SANFORD UNDERGROUND LABORATORY NEWS

Liquid nitrogen at the Yates Shaft

During the last week of September, a new 3000-gallon bulk tank was installed near the top of the Yates Shaft, just outside the headframe (shown in Figure 4). A ready supply of cold liquid nitrogen is essential to operate the two current experiments at the Davis Campus.

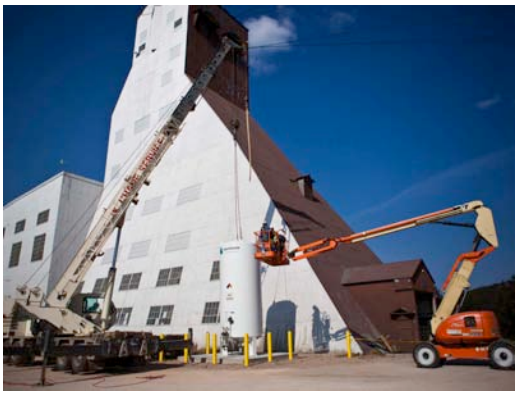

Figure 4: Facilities Tech Kevin Ehnes (in the basket) operates a lift to reach the straps used to hoist the new liquid nitrogen bulk tank into place

Science Liaison Director Jaret Heise reported that the Large Underground Xenon (LUX) dark matter detector will require delivery of liquid nitrogen almost daily. The MAJORANA DEMONSTRATOR (MJD) experiment depends on liquid nitrogen to keep its

germanium crystals cold. MAJORANA also uses nitrogen as the cover gas inside its super-clean gloveboxes.
Experiment Safety Manager Chuck Lichtenwalner says that a system is being designed to pipe liquid nitrogen from the bulk tank outside into the headframe building itself, where it can be transferred to Dewar flasks for transport to the 4850 Level underground of the Davis Campus.

Technical Support Lead Jim Hanhardt helped develop safe transport procedures for nitrogen. Lichtenwalner is deputy chairman of the Cryogen Safety Committee, which includes members from Fermilab and LBNL. The committee reviewed calculations and analyses for oxygen deficiency hazards to ensure safe use of nitrogen underground.

Ross Shaft Construction Update

During the last week of September, Foreman Gary Larson and members of the surface operations crew removed the north skip from the Ross Shaft, and replaced it with a new work deck (shown in Figure 5). This major step is needed in order to start the replacement of steel in the 5000-foot Ross Shaft. This was no small job: the skip weights 17,000 pounds.

Figure 5: Infrastructure techs Loren Larsen, Chris Huber, and Jeff Essink helped remove the north skip from the Ross Shaft. The skip is the tall brown device at the back of the photo. Larson inspects the work deck (red) in the cage compartment of the shaft. The new crane (blue) is attached to the top of the work deck

The new work deck includes a small crane that can be used to lift old steel out of the shaft. George Vandine, Foreman of the Ross Shaft rehabilitation program said the new work deck will make the operation more efficient, effective, and safer.

The Ross Shaft has four main compartments that run the length of the shaft. The north and south skip compartments were used for hauling ore out of the old Homestake mine. The cage compartment was used for the conveyance that hauled personnel and equipment. Work decks in the skip and cage compartments will allow crews complete access to the Ross Shaft during the five-year project to replace the shaft's steel. The south skip will remain in the shaft, available to haul old steel out of the shaft.

Safety at Sanford Lab

Environment, Health and Safety Director Joe Gantos has rolled out guidelines for a new safety procedure to be implemented by SURF managers. The procedure is designed to ensure that when anyone makes a safety suggestion or raises a safety concern, that managers will act on these reports. Follow-up discussions on actions taken will take place with employees.

"It is a system that managers will use to engage employees in safety discussions," said Gantos.

Gantos has divided the Sanford Lab managers into four teams. Managers in each team will summarize safety issues each week. This will include reports on 5-point safety cards. The summaries will be submitted to Joe Gantos and Lab Director Mike Headley, and will be presented at SURF weekly meetings. The process will begin in the field, at work sites, with observations, discussions, and actions to make Sanford Lab and SURF an even safer workplace.

Shoe Safety: Visitors to the Davis Campus must wear booties over their shoes, and personnel who work there regularly keep clean shoes underground. Low-cut hard-toe shoes like the pair to the left meet the ASTM F2413 standard. They are acceptable for lab work. Lab workers will wear ankle-high hard-toe boots from the Lab surface to the Davis Campus.

Like SURF on Facebook:
http://www.facebook.com/SURFatHomestake

EDUCATION AND OUTREACH

Students and Teachers

Recent groups taking part in Education and Outreach activities at Sanford Lab included:

Black Hills State University, Spearfish, South Dakota - Analytical Chemistry Class: The analytical chemistry course at BHSU utilized Sanford Lab's waste water treatment effort as a case study. Students toured the Waste Water Treatment Plant during their lab period, returning to the BHSU campus with some 'red sludge' to analyze in class.

Newcastle High School, Newcastle, Wyoming - Chemistry and Physics classes: Students heard a talk from Peter Sorenson (LLNL) of the LUX collaboration, toured the Hoist Room, and discussed the possible use of Sanford Lab data in upcoming science projects.

Star Academy, Custer, South Dakota – High school students: This boarding school for at-risk youth brought twelve students to the facility. One group performed an activity on electricity and magnetism with SURF Education Specialist Julie Dahl and toured the Hoist Room. The second group did activities on spectroscopy and learned about dark matter with Deputy Director of Education and Outreach Peggy Norris. They also heard a talk on the engineering behind moving the LUX detector from SURF Project Engineer Wendy Zawada and did an engineering activity based on the LUX move.

Offsite student groups:

Lead-Deadwood Middle School, Lead, South Dakota – 8th grade science classes: Students learned about Sanford Lab and did an inquiry-based activity on tiltmeters. They then looked at data from the tiltmeter at the 2000 Level and used it to calculate the distance at which an earthquake had occurred.

SciGirls of the Black Hills: September meetings took place in Rapid City (West Middle School and the Journey Museum), Spearfish (Spearfish Middle School) and Belle Fourche (Belle Fourche Middle School). The September program focused on properties of plastics and the hows and whys of plastic recycling.

Figure 7: The SciGirls club at Belle Fourche Middle School explores density while learning about plastic recycling

Brown Bag Seminar at Sanford Lab

The most recent Lunch and Learn Brown Bag seminar took place on October 17 in the Yates Education Building. Bill Roggenthen, Research Scientist at South Dakota School of Mines & Technology spoke about the nature of the Earth's magnetic field and how it interacts with rocks in the Earth's crusts. Participants also looked at experiments in magnetization and how the history of the Earth's magnetic field is recorded in the rock record. Participants brought their own lunch, and Peggy Norris prepared a crock pot of soup.

The next Lunch and Learn Brown Bag seminar will take place on November 28 with Sanford Lab Communications Director Bill Harlan.

Connecting Science and the Arts

On December 3-4, Jodi Lamask, Artistic Director of *Capacitor Dance*, will be giving public lectures and master classes for dance students in Spearfish (December 3) and Rapid City (December 4). Upon founding *Capacitor* in 1997, Jodi Lomask began exploring non-traditional combinations of arts and sciences through movement. Under her artistic direction, *Capacitor* created works that tackle the past and future of reproduction (futurespecies, 2000), Earth's duet with the Universe (WithinOuterSpaces, 2001), the heroism and fantasy of video gaming (Avatars, 2002), the visible and invisible layers of the Earth into the core (Digging in the Dark, 2004) and an exploration of desire and yearning in the natural world (biome, 2007). Lomask's uncanny and contemplative use of technology and science won her invitations to speak at the Monaco Dance Forum and the Ecological Society of America meeting. Her work has been covered by *Nature Magazine, Wired.com, Res*

magazine, SHIFT magazine, NBC 11's Tech NOW!, CNET Radio, TECH TV, Dance Magazine, San Francisco Magazine, and *The New York Times*. The event is sponsored by BHSU and the Dahl Arts Center, with financial support from Brian Schwartz and the NSF through the Science and the Arts program at the City University of New York Graduate School.

ENVIRONMENT, HEALTH & SAFETY

Halloween Safety

Have fun and be scary! Look both ways before crossing the street, and stay in well-lit areas. Carry a flashlight or glow stick, or use reflective tape on your child's costume.

Drive carefully, especially if it is raining, and watch for trick-or-treaters crossing the road. If you illuminate your jack-o-lanterns, keep a close eye on the lit candles or use flameless candles.

Keep your household pets safe inside on Halloween night. Pets cannot tolerate chocolate; provide them with their own treats.

Safety pages on Sanford Lab website:
www.sanfordlab.org - Use the left hand menu

UPCOMING CONFERENCES AND WORKSHOPS

2012 Fall Meeting of the APS Division of Nuclear Physics. October 24-27, 2012, Newport Beach, California. Hyatt Regency, Newport Beach.
http://physics.ucr.edu/dnp2012/

Underground Synergies with Astro-particle Physics: Multi-Disciplinary Studies in the World's Deep Underground Science Facilities. Durham, United Kingdom. December 18-19, 2012.
http://indico.cern.ch/conferenceDisplay.py?confId=199223

Underground Science Experiments & Research Seminars (USERS) continue bi-weekly on Thursdays, 1:30-2:30 PM. Alternate sessions will be held at LBNL and UC Berkeley, 325 Old LeConte Hall. If you are interested in attending these seminars please subscribe to this email list for future announcements:
http://dusel.org/mailman/listinfo/ugsseminars

DURA Events: Please send information regarding upcoming meetings of interest to DURA members to Richard_Gaitskell@brown.edu or jswang@lbl.gov.

JOBS

Postdoctoral position at Physics Division, LBNL, Berkeley. 2013 Chamberlain Fellowship in experimental particle physics and cosmology. Deadline: 11/1/12. Contact AVPagsolingan@lbl.gov
https://academicjobsonline.org/ajo/jobs/1715

Professor and Assistant Professor positions, Physics Dept., Temple University. The tenure-track positions are open to theoreticians and experimentalists in all fields of Physics. Deadline: 1/31/13.
http://phys.cst.temple.edu/professor
http://phys.cst.temple.edu/assis-professor

Assistant Professor position in Experimental Particle Astrophysics, Dept. of Physics & Astronomy, University of South Carolina. Collaborate with ultra-low background searches for dark matter, zero neutrino double beta-decay, and axions. Prof. Frank T. Avignone, Chair of Particle Astrophysics Search Committee, USC Physics & Astronomy, 712 Main St., Columbia, SC 29208. avignone@sc.edu. Deadline: 11/30/12.
http://www.physics.sc.edu

Assistant Professor position in Experimental Nuclear Physics, Duke University. Research in electroweak interactions, neutrino physics, hadron structure, and nuclear astrophysics. Queries to: Calvin Howell, Chair of the Search Committee, howell@tunl.duke.edu. Deadline: 11/30/12.
http://www.tunl.duke.edu/web.tunl.2011a.jobs.php

Faculty position in Experimental Physics, Stanford University. Focus on fundamental particles and interactions; areas of interest could include article physics, particle astrophysics, gravitational physics and precision measurements. Graduate and undergrad level. Deadline: 12/1/12.
https://academicjobsonline.org/ajo/jobs/1827

Postdoctoral Fellowships in Experimental Physics, INFN, Italy. Particle Physics, Astroparticle Physics, Nuclear Physics, and Technology Research. Sixteen positions available for non-Italian citizens at various INFN sites. Deadline: 11/30/12. http://www.ac.infn.it/personale/exp_fellowships/

Postdoctoral positions – Experimental Particle Astrophysics, Queens University. Research on DEAP-3600 dark matter experiment. Mark Boulay, Assoc. Prof. & Canada Research Chair in Particle Astrophysics, DEAP Project Dir., Dept. of Physics, Queen's Univ., Kingston, ON K7L 3N6 Canada, c/o Louise Segsworth. louise.segsworth@queensu.ca http://www.sno.phy.queensu.ca/group/

Postdoctoral Associate – Center for Neutrino Physics, Virginia Tech. Study of neutrino oscillations, working primarily on the Daya Bay Reactor Neutrino Experiment in China. Prof. Jonathan Link, jmlink@vt.edu, Virginia Tech Physics Dept., 317 Robeson Hall, M/C 0435, Blacksburg, VA 24061. Job #0121584. http://www.jobs.vt.edu

Postdoctoral Research Associate in Astroparticle Physics – Purdue University, Indiana. Participate in XENON Dark Matter search. Design calibration systems, analyze data from the XENON100 experiment. Dr. Rafael Long, c/o Emjai Gregory, Purdue University, Dept. of Physics, 525 Northwestern Ave., West Lafayette, Indiana 47907. egregor@purdue.edu.

Wilson Postdoctoral Fellowship – Fermilab, Batavia, Illinois. Self-directed research in experimental physics for candidate with at least 2 years of postdoctoral experience. Deadline: 10/26/12. Wilson_fellowship@fnal.gov. https://academicjobsonline.org/ajo/jobs/1802

Process Development Engineer – Fluke Corporation. Knowledge of Physics, Electronics, and Material Science will be relevant. Position is at corporate headquarters in Seattle. https://danaher.taleo.net/careersection/external/jobdetail.ftl?lang=en&job=FLU000738

Newsletter Editor: Melissa Barclay
Contributors: Kevin Lesko; Bill Harlan (Sanford Lab local news); Andreas Best (DIANA project update); Peggy Norris, Ben Sayler (Education and Outreach)

Photo Credits: Fig. 1: http://accelconf.web.cern.ch/accelcon/PAC2011/papers/froan2.pdf; Figs. 2,4-5: Matt Kapust; Fig 3: Steve Babbitt, BHSU; Fig. 6: Julie Dahl

SURF CONTACT INFORMATION

Lawrence Berkeley National Lab
Kevin T. Lesko: 510-486-7731
KTLesko@lbl.gov
Melissa Barclay: 510-486-5237
mbarclay@berkeley.edu
http://www.dusel.org/
SDSTA/Sanford Lab
Ron Wheeler, Executive Director
Mandy Knight, 605-722-8650, x222
MKnight@sanfordlab.org
http://www.sanfordlab.org/
South Dakota School of Mines and Technology
William Roggenthen: 605-394-2460
William.Roggenthen@sdsmt.edu

BERKELEY OFFICE
New address !

SURF Project Office
Lawrence Berkeley National Lab (LBNL)
One Cyclotron Road
MS 50B-5239
Berkeley, CA 94720