**Dear SURF Readers,**

Welcome to the November 2012 Sanford Underground Research Facility (SURF) monthly newsletter. The newsletter is also posted online, and a pdf copy is available. You can read recent and archived newsletters at our new website at www.sanfordlab.org. We are 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**

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

## Life in Lead for the LBNL MAJORANA group

The LBNL MAJORANA group has started to increase their presence underground, and with that their presence in Lead. Postdocs Ryan Martin, Susanne Mertens, and Nicolas Abgrall are involved in the assembly of the germanium detectors for the MAJORANA DEMONSTRATOR experiment (shown in Figure 1). The town of Lead has started to become like a second home to them as they are staying for long periods of about four to six weeks.

They share a two-storey duplex with their Berkeley colleagues from the SURF Project Office, as well as members from the Berkeley LUX group. The house is conveniently located within walking distance to the SURF Yates complex where they are working, and to Main Street in Lead. The LBNL postdocs have become well-integrated to the town, and have become regular customers at Bob's Silver Star Bar and Lounge located on Main Street.

Working underground is a new experience for some of the group, while others have had the experience of previously working on the Sudbury Neutrino Observatory. Getting up at 5:30 a.m., catching the 7:30 a.m. cage to the underground, and going through the extensive garbing procedures to enter the MAJORANA clean room is quickly starting to become a regular routine. As the construction of the MAJORANA experiment ramps up, the group looks forward to spending more time in the local community, such as wine tasting at the Schadé winery in Deadwood, eating fish sandwiches at the many restaurants, and enjoying Lewie's famous Shirley Temples in Lead.

In the months to come, we look forward to following the progress of the MAJORANA experiment. To read more about the experiment, see page 2.

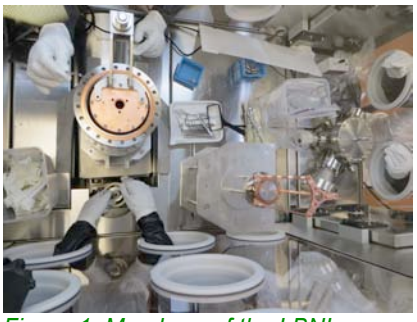

*Figure 1: Members of the LBNL group and their colleagues working in the MAJORANA glove box at SURF*

## LBNE update

The LBNE project passed its DOE CD-1 cost review during the first week of November. The review was held at Fermilab, and went ahead despite threats from Hurricane Sandy. About half of the review team and a third of the presenters who live on the East Coast and were unable to make the trip, joined by teleconference. The review went well; LBNE has been recommended for CD1 approval, subject to adjusting a few details. CD-3A is planned for April of 2015 and CD-2 for April of 2016.

LBNE also just passed a surface operation review. Simulations indicated that a combination of passive shielding and the precise pattern recognition provided by the Liquid Argon Far Detector (LAr) can reject backgrounds to at most a few events per year. An independent review concluded that this analysis is sound and that risk is manageable.

LBNE currently is focusing on the first phase of the configuration: the 10-kiloton LAr detector to be located on the surface at SURF. During Phase 2, LBNE scientists and reviewers will focus on plans for installing the underground detector at SURF. If additional new funding is identified in the coming years, there are compelling physics reasons to move the Phase I detector underground and pursue a variety of high priority physics topics from the start.

### 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 available at:
http://www.dusel.org/html/early-science-progress.html

### New SURF website

The new SURF website was launched on November 15. http://www.sanfordlab.org/

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


### SURF IN THE NEWS

*Yahoo News (AP): Dark matter detector nearing activation in SD mine* (Amber Hunt, November 20)

*Symmetry.com: Time projection chambers: a milestone in particle detector technology (Jessica Orwig, October 10)*

*LBNL News Center: First Purified Germanium Delivered to MAJORANA DEMONSTRATOR* (November 15)

*Black Hills Pioneer (with Wendy Pitlick): A gold mine of knowledge* (October 29)
*Dark matter film to feature Sanford Lab* (October 22)
*Not just for science* (October 15)
*Sanford Lab education spans ages* (October 9)

South Dakota Public Radio (http://www.sdpb.org): SURF Operations Safety Officer Tom Regan interview, November 1.

*Washington Examiner: SD gold mine and underground lab official retiring (October 30)*

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

### DURA Election and meeting

The Underground Research Association Executive Committee (DURAC) is calling for nominations and will hold an election before the next annual meeting of DURA. The DURA meeting is scheduled to be held on March 5, 2013 at SLAC in Palo Alto, prior to the Cosmic Frontier Meeting and Workshop of March 6-8. Please contact the chair Richard Gaitskell (Richard_Gaitskell@brown.edu) to recommend DURA members who are interested in serving on DURAC. Currently, DURAC has seven members from Physics experiments, and two members from Bio-Geo-Engineering (BGE) backgrounds. The terms for DURAC are normally for three years.

## SANFORD UNDERGROUND LABORATORY NEWS

### MAJORANA DEMONSTRATOR (MJD) Update

In mid-October, the first batch of liquid nitrogen (LN) was delivered to the 4850 Level for use in the MJD experiment. Two 180-liter cryogenic containers--dewars--are being stored in a special room off of the main corridor of the Davis Campus.

Moving liquid nitrogen is a careful process. Science Liaison Supervisor Connie Giroux and Infrastructure Tech Alvin Burns filled each dewar from the large LN tank near the Yates Shaft headframe. Once they arrived at the 4850 Level, Infrastructure Tech Charlie Roth and Facilities Tech Oren Loken delivered the LN to the cart wash, where they were met by Lab custodian Robyn Varland (shown in Figure 2).

*Figure 2: Oren Loken, Robyn Varland and Charlie Roth secure an LN dewar in the cart wash*

SURF Senior Project Manager David Taylor, Engineering Project Manager Mike Johnson, and MJD Principal Investigator physicist Steve Elliott of Los Alamos National Lab, along with MJD colleagues (shown in Figure 3), moved the dewars into the MAJORANA LN storage room. Detectors need to be kept cold. MAJORANA will have to cool about 40 kilograms of germanium crystals, using a supply of 360 liters of LN. The LUX dark matter detector will have to keep 350 kilograms of xenon in a liquid state, at minus 160 F. This will require 1800 liters of LN to be stored underground.

*Figure 3: Steve Elliott en route to the storage room with Kirill Pushkin, Nicolas Abgrall, Graham Giovanetti, David Taylor, and Ryan Martin*

 On November 9, the first batch of electronics-grade germanium was delivered to a contractor in Oak Ridge, Tennessee. The next step in the process will be to turn the electronics-grade germanium into detector-grade germanium. The MAJORANA DEMONSTRATOR will use ultra-pure germanium enriched to 86% in the isotope, $^{76}$Ge, to search for neutrinoless double-beta decay, once MJD construction is completed at the 4850 Level Davis Campus.

Germanium oxide is produced in Russia, and then shipped to Oak Ridge in 20-foot sea containers, inside steel-shielded vessels to protect it from cosmic radiation. Once it arrives, the oxide is stored in Cherokee Caverns, a commercial cave near Oak Ridge. The germanium is then delivered to *Electrochemical Systems*, a company that transforms the germanium oxide into an electronics-grade product.

*Electrochemical Systems* then delivered the first 9 kilograms of electronics-grade germanium to *AMETEC/ORTEC*, also located in Oak Ridge. *AMETEC/ORTEC* will further purify the germanium until the concentration of $^{76}$Ge reaches 86 to 87 percent. The company will then grow ultra-pure crystals of $^{76}$Ge.

Alan Poon, Lawrence Berkeley National Laboratory Physicist and detector group leader for MAJORANA, traveled to Oak Ridge to monitor quality control on this process which is critical to the experiment's success. MAJORANA will use 30 kilograms of pure germanium crystals in their experiment, Poon reports. The finished pure crystal will temporarily be stored in Cherokee Caverns until a larger shipment is sent to Sanford Lab. Arrival is expected in the beginning of 2013, where it will be stored underground.

## LUX Progress

At the end of October, LUX researchers began filling the water tank that will help to protect the Large Underground Xenon (LUX) dark matter detector from natural radiation (shown in Figure 4). By November 15, the stainless steel tank was filled.

*Figure 4: Small stream of water (left) filling the LUX water tank at the 4850 Level. The LUX detector (center) is 6 ½' x 3' diameter. Photomultiplier tubes hang on the sides of the tank.*

Physicist Harry Nelson of UC Santa Barbara, the water sub-system manager for the LUX experiment, directed the procedure. The pure water comes from

a custom-made filtration and de-ionizing system designed and built by Roy Hall of *South Coast Water* in California. The equipment is installed just outside the Davis Cavern.

The LUX equipment was installed at the 4850 Level underground in July 2012, and the detector was then lowered into a stainless steel tank 20' H x 25' diameter.

By the morning of October 29, about 15,000 gallons of water had been delivered to the tank. Nelson reported that this was enough to fill it to a level of approximately 4 feet. The water tank is lined with 20 photomultiplier tubes PMT's. Once water covered the bottom row of PMT's, researchers began testing. Over the next few weeks, additional water was added until the tank reached its capacity of 71,600 gallons. Periodic, thorough testing has revealed that so far the PMT's and LUX electronics are functioning properly. Further tests of the experiment's electronic systems will continue into November and December. Researchers hope to begin collecting data in early 2013.

### Safety at Sanford Lab

Sanford Lab has rolled out cleanliness protocols for the Davis Campus, starting November 7. The main changes include:

- Hand-carried items need to be bagged. Bags will be provided.
- Boot covers need to be worn when entering the cart wash from the clean side. (Also provided)
- Visitors need to wear coveralls, either to the shed coming into the clean area or other options if this is not possible.

## EDUCATION AND OUTREACH

### Girl Scouts

The Girl Scouts of America are committed to engaging girls of all ages with science, technology, engineering, and mathematics (STEM) experiences. Local leadership is often looking for presenters for these events. The Sanford Lab Education Department aided regional coordinators in planning two STEM events recently. In Rapid City, a Spooky Science event on October 26 drew 150 girls of all ages. Students from SDSMT presented activities in chemistry and earth science, and Brianna Mount of BHSU, a postdoc with Professor Kara Keeter, introduced the students to the properties of dry ice. Another 140 girls in grades K-8 participated in a 'Girls and Gadgets' STEM event in Bismarck, North Dakota on November 17. Peggy Norris and Julie Dahl ran activities on Rutherford Scattering/Indirect Evidence and Nanotechnology, respectively.

*Figure 5: Young Girl Scouts from the Bismarck area explore indirect evidence using mystery boxes assisted by 8th grade volunteer Abby*

### Family Science

Corral Drive Elementary School in Rapid City held a family science night recently. Julie Dahl represented Sanford Laboratory. Over 100 kids and parents participated in Dahl's experiments with Rutherford Scattering/Indirect Evidence.

### Brown Bag Seminar at Sanford Lab

The next Lunch and Learn Brown Bag seminar will take place on November 28 with Sanford Lab Communications Director Bill Harlan. Bill will talk about best practices in science communication. Lunch and Learn events are held in the Conference Room in the Yates Education Building.

### Connecting Science and the Arts Event

*December 3-4:* Jodi Lomask, 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 Dr. Brian Schwartz, a physicist at the City University of New York Graduate School, and his NSF-funded Science and the Arts.

*Figure 6: Total solar eclipse photo taken by a colleague and fellow traveler of Peggy Norris. Peggy has just returned from a trip where she was able to view the solar eclipse off the coast of Cairns, Australia (Courtesy of TravelQuest International)*

## ENVIRONMENT, HEALTH & SAFETY

### Thanksgiving Safety

Stoves and ranges should be turned off when you leave the kitchen. Unattended cooking is the leading cause of Thanksgiving Day fires.

Minor burns can be treated by running under cold water or using over-the-counter ointments and pain relievers. Do not apply butter to the burn.

Sage will add savor to your turkey stuffing, but cats may be allergic. Do not give raw turkey or turkey bones to pets. Provide them with their own pet food feast.

## STAFF NEWS

**Tom Regan,** Operations Safety Officer, has retired, after a total of 43 years with the *Homestake Mining Co*. and SURF. During his long tenure, he has worn many hats, at first working nights as a student laborer in 1969 while attending Black Hills State University full-time. Regan has also been a locomotive operator, a miner, heavy equipment operator, and a scheduler. He planned special projects for the mining company, including the installation of the 6950-foot level ventilation plant, the sinking of the Four Winze and Six Winze shafts, and other projects associated with deepening the 8000-foot gold mine beyond 6800 feet. Later, he was the mine services planner, taking care of all the underground work not directly associated with mining, such as construction, sand, locomotive haulage, and backfilling.

In 1998 when *Homestake* planned to close and was laying off employees, Regan was retained to help with the mine optimization program. Two years later, when *Homestake* merged with *Barrick Gold Corp*., Regan was severed from *Homestake*, but returned the following week as a consultant.

*Figure 7: Tom Regan's retirement party on November 2 with family, friends and Sanford Lab staff. Tom is seated in the center*

Regan was directly involved in the transition from mining to science, working with local officials and state agencies who believed that the mining site could have a future. As closure foreman, Regan inspected 370 miles of drifts or tunnels, with the idea in mind that the mine space, with its equipment and tools might be used again. Five years later, at the reopening, Regan inspected the same drifts and coordinated a safety plan. In the photo above, he is shown holding a closure sign.

Since 2007, Regan has been the Operations Safety Officer at Sanford Lab. Regan will continue to act as a part-time consultant to SURF.

## UPCOMING CONFERENCES AND WORKSHOPS

**AGU (American Geophysical Union) Fall meeting,** Moscone Center, San Francisco, CA. December 3-7, 2012. http://fallmeeting.agu.org/2012

**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

**American Physical Society April annual meeting,** International Physics Focus Group, Sheraton Denver Downtown Hotel, Denver, CO. April 13-16, 2013. Abstract due date: January 13, 2013. http://www.aps.org/meetings/april/

**New Directions in Neutrino Physics,** Aspen Center for Physics, Aspen Colorado. February 3-9, 2013. http://aspenphys.org/physicists/winter/currentconferences.html

**DURA meeting,** SLAC, Menlo Park, CA. March 5, 2013 before the Cosmic Frontier workshop.

**Cosmic Frontier Workshop 2013**, SLAC, Menlo Park, CA. March 6-8, 2013. http://www-conf.slac.stanford.edu/cosmic-frontier/2013/

**Workshop in Low Radioactivity Techniques, Laboratori Nazionali del Gran Sasso (LNGS), Italy.** April 10-12, 2013. This workshop examines topics in low radioactivity materials and techniques, which is probably the most fundamental part of rare event physics detectors, such as for solar neutrinos, dark matter, double-beta decay, and long half-life phenomena. This conference is intended to be wide in scope to include all aspects of the development of low background detectors and techniques. http://lrt2013.lngs.infn.it

**SINOROCK Third Symposium,** Tongi University, Shanghai, China. June 13-16, 2013. A URL workshop will be held on June 12. http://www.sinorock2013.org

**ARMA, 47th US Rock Mechanics/Geomechanics Symposium,** Westin San Francisco Market Street, San Francisco, CA. June 23-26, 2013. http://armasymposium.org/

**Community Summer Study 2013 (SNOWMASS on the Mississippi.** Minneapolis, MN, July 29-August 6, 2013. Sessions on five particle physics frontiers: cosmic energy, facilities, instrumentation, and intensity. http://www.snowmass2013.org

**EUROCK 2013, ISRM International Symposium,** Congress Centre, Wroclaw University of Technology, Wroclaw, Poland. September 21-26, 2013. Rock Mechanics for resources, energy, and environment. http://www.eurock2013.pwr.wroc.pl/index.php?id=0

**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: 12/1/12. Contact AVPagsolingan@lbl.gov https://academicjobsonline.org/ajo/jobs/1715

**Tenure track faculty positions in Physics at South Dakota School of Mines.** New SURF-related research program in particle physics, studying neutrino physics, dark matter, proton decay, and related research that requires deep underground shielding and low-background counting; also seeking a specialist in computational physics. Job #: 0004996. Deadline: 1/7/13. http://www.sdsmt.edu/employment

**Postdoctoral Research Assistant for the SNO+ experiment. Department of Particle Physics, University of Oxford, England.** Explore a diverse range of physics, including neutrinoless double beta

decay, low energy solar neutrinos, and neutrinos from supernovae. Deadline: 1/11/13.
s.biller1@physics.ox.ac.uk; s.geddes1@physics.ox.ac.uk
http://www2.physics.ox.ac.uk/about-us/job-opportunities

**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

**Postdoc Position, for the GERDA experiment, Max Planck Institute, Munich.** Analysis of GERDA data, help install and commission the GERDA upgrade. Apply to: Max-Planck-Institut für Physik, (Werner-Heisenberg-Institut), Ina Wacker, Föhringer Ring 6, 80805 München. ina@mpp.mpg.de
http://cerncourier.com/cws/job/J000007344

**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 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.

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