Dear SURF Readers,

Welcome to the May 2013 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 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

June 3-7: LZ Technical Workshop – Imperial College, London

June 24 – July 26: CETUP* Workshop – Lead, SD

DIANA chooses Sanford Lab

The DIANA scientific collaboration has chosen Sanford Lab as the preferred site for the Dual Ion Accelerators for Nuclear Astrophysics (DIANA) experiment, led by University of Notre Dame (UND) Physics Professor Michael Wiescher. In addition to UND, the DIANA collaboration includes researchers from Michigan State University, the University of North Carolina, Western Michigan University, Colorado School of Mines, and Lawrence Berkeley National Laboratory, as well as from a number of researchers from European Institutions.

Figure 1: Graphic conception of DIANA facility as currently planned, consisting of two high-intensity, low-energy accelerators

DIANA will use two small accelerators to replicate fusion reactions inside stars. The experiment could run for decades. Scientists and engineers are investigating a site at 17 Ledge on the 4850 Level of the Davis Campus. The selection of Sanford Lab was made after reviews by the DIANA collaboration, external independent reviewers, the National Science Foundation, and a project selection committee. DIANA is currently working with the NSF on funding for design and construction, but the site selection allows the collaboration and Sanford Lab to continue design discussions and planning. (More on DIANA to come in future SURF newsletters!)

SURF takes precautions because of rain

On May 21, Sanford Lab suspended operations deep underground after a five-day storm dropped 8.75 inches of rain on the northern Black Hills. The suspension included science operations at the 4850 Level.

"Safety is always our first consideration," said Laboratory Director Mike Headley. "So far, our underground systems are performing as expected." However, an inspection team reported water backing up in some areas of the upper levels, so the Lab temporarily prohibited access below the 1850-foot level to give the water control systems a chance to catch up.

The two physics experiments on the 4850 Level are the Large Underground Xenon (LUX), and the MAJORANA DEMONSTRATOR (MJD). The LUX detector is already assembled and undergoing testing; MJD'S is under construction.

Sanford Lab Science Director Jaret Heise said that the short suspension would not damage either experiment. "We're prepared for unusual events," Heise said. "Both experiments are safe and secure."

On May 23, SURF staff inspected the Yates Shaft service compartments and intersecting stations/drifts that play a role in the Lab's dewatering process. The inspection team reported that water levels had receded, but underground access would continue to be limited at least until May 29, at which time additional inspections will take place.

The current water level of the deep pool is just below 5900 feet underground. Even if the deep pumps were turned off, it would take about a year to reach experiments on the 4850 Level.

LUX Collaboration meeting

On April 19-20, some 40 LUX Collaboration members met amid the snow and cold (shown in Figure 2) at Sanford Lab. The snow and blizzards that swept the Midwest in early to mid-April caused Sanford Lab to close for a few days, and some travelers en route to South Dakota were grounded in various airports. Still, "The meeting was quite a success," said Yale Physics Professor Dan McKinsey, a spokesperson for the LUX experiment. This is an exciting time in the life of the experiment, as scientists and researchers start runs and begin to understand how the detector will perform.

Figure 2: Members of the LUX collaboration at April 19-20 meeting in Lead

Physicist, oceanographer, and BBC2 broadcaster Helen Czerski interviewed LUX co-spokesperson Rick Gaitskell (shown in Figure 3, braving the elements) on April 16. The BBC2 crew spent most of the day underground at Sanford Lab videotaping a segment for a programme on dark matter. Czerski is well known in the UK as a co-presenter of a BBC2 series *Orbit: Earth's Extraordinary Journey.* In March, a BBC1 crew visited LUX to produce a segment on dark matter.

Figure 3: BBC2 broadcaster Helen Czerski interviews LUX Physicist Rick Gaitskell at Sanford Lab

New Secretary of Energy

On May 16, the United States Senate confirmed Ernest Moniz to be the new Secretary of Energy. He will replace Stephen Chu, who had held this position since 2008. Dr. Moniz graduated from Boston College, and completed his Physics PhD at Stanford. He has been a faculty member at MIT since 1973, and served as the Director of the MIT Energy Initiative. He has also served in the White House Office of Science and Technology Policy and as an Undersecretary of the Department of Energy during the late 1990s.

Reports/Papers Available

Paper: "The Large Underground Xenon (LUX) Experiment" has been published in *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment,* Vol. 704, 11 March 2013, pp. 111–126.

For news, *twitter* updates, and other features see the SURF website: www.sanfordlab.org

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

SURF IN THE NEWS

BBC News Science & Environment: Dark matter experiment CDMS sees three tentative clues (Jason Palmer, April 15)

NBCNews.com: *Scientists see three promising blips in underground dark matter search* (Alan Boyle, April 16)

Fermilab Today: DIANA chooses Sanford Lab (May 17)

Aberdeen News: Winners named in 2013 Great Plains Associated Press awards (April 24)

Black Hills Pioneer (Wendy Pitlick): *Sanford Lab Selected!* (May 18)
Deep Science (April 25)

Searching for WIMPS (April 20)

DURA News

To comment on DURA, please contact chair Richard Gaitskell (Richard_Gaitskell@brown.edu). For Bio-Geo-Engineering matters, contact Bill Roggenthen (William.Roggenthen@sdsmt.edu). For further information on DURA, see: http://sanfordlab.org/dura

SANFORD UNDERGROUND LABORATORY NEWS

Ross Shaft Construction Update

The Ross Shaft Steel replacement, a long-term project to replace all steel in the 5000-foot shaft, has progressed from the top of the shaft to below 560 feet, as of mid-May, reports Underground Access Director Will McElroy. Once the project is completed, the Ross Shaft will meet engineering requirements for extracting rock and lowering equipment and materiel down the shaft in support of large experiments such as LBNE and DIANA.

Figure 4: Infrastructure technicians Joe Nonnast (lower) and Loren Larsen maneuver a diagonal steel brace into place in the Ross Shaft

The new steel is built in 18-foot sets. Every 10 sets (or 180 feet), the crews install "saddles" to hold bearing beams (as shown in Figure 4). The saddles include a horizontal beam and two diagonal braces, installed side by side. Saddles are attached to the walls of the shaft by steel bolts that penetrate the rock up to 11 feet. Each 1-inch diameter bolt has a tensile strength of 15-Ksi (kilo-pounds per square inch).

Sanford Lab Water Treatment Plant

Sanford Lab has received high marks for the fifth year in a row from *GEI Consultants,* the independent contractor that monitors water quality in nearby Whitewood Creek. A March 2013 report is based on sampling from summer 2012, as it takes about six months to analyze all the data.

The consultants examined habitat conditions, measured populations of fish and other aquatic life including insects, crustaceans, and mollusks, as well as algae and certain types of microbes. *GEI* reported that Sanford Lab's outfall "had healthier invertebrate and periphyton communities, indicating that not only are there no negative effects from discharge, but (there are) potential positive effects from increased stream flow and water quality."

Sanford Lab discharges its water directly into Gold Run Creek which joins Whitewood Creek (shown in Figure 5). Gold Run Creek does not have enough water flow to support fish, reports Sanford Lab Environmental Manager John Scheetz, but Whitewood Creek is home to brown trout. *GEI* reported that Whitewood Creek's habitats are healthier below Gold Run Creek, which means that Sanford Lab is actually improving the water quality in the stream.

Figure 5: Whitewood Creek on April 15

Water treatment at Sanford Lab is a major undertaking. In addition to treating water from underground (mainly removing iron), the plant also treats water—removing trace amounts of ammonia--from the Grizzly Gulch tailings impoundment, still owned by *Homestake Mining Co.* Sanford Lab has treated 3.85 billion gallons of water since June 2008, and on the micro-scale, currently treats 400 gallons per minute from each source.

"Our six water treatment plant operators do an excellent job," Scheetz said. Operators include Troy Derby, Duane Ehnes, Pat Hasson, David Johnson, Ken Noren, and Jackson Pahl. The crew also blends water to maintain low temperatures and low concentrations of dissolved solids, and restricts pumping from underground to the nighttime hours when electricity costs are lowest.

Safety at Sanford Lab

SURF management recently convened to discuss ideas to improve safety at Sanford Lab. Director Mike Headley has requested feedback from staff and management on safety issues affecting the Lab. He is impressed with the progress that has been made in encouraging and strengthening lab safety culture since the Davis Campus was opened for underground science in May 2012. Safety incidents are reported quickly and action is taken immediately to resolve the issue and improve safety going forward. A safety improvement plan has been drafted with the goal to focus on increased involvement from SURF staff and scientific researchers in identifying and resolving safety issues, and increased management engagement in safety concerns.

Figure 6: Photo illustration created for the May Safety Loop newsletter

James Hopmeier has been producing a newsletter, *Safety Loop* for the Sanford Lab. This month, he focuses on the "near miss" (shown in Figure 6).

OHSA defines a "near miss" as an incident "where no property was damaged and no personal injury was sustained, but where, given a slight change in time or position, damage and/or injury could have occurred." SURF is looking closer at near misses to find ways to prevent serious accidents.

Think back to famous major accidents. In 2010, BP's Deepwater Horizon drilling platform exploded and sank into the Gulf of Mexico. In 2003, the Space Shuttle Columbia exploded above Texas. In 1986, the Space Shuttle Challenger exploded just a few minutes after it lifted off from Florida. Each of the three disasters tragically resulted in loss of life, and could have been prevented. In fact, the causes of each of these accidents had been observed prior to the catastrophic failures. In the case of the Deepwater Horizon explosion, engineers knew that certain well-control failures could lead to explosions.

Sanford Lab has a good record of incident reporting and plans to maintain that. The Sanford Lab safety team plans to study the lab's near misses and act on what they learn. That way, they can take steps to avoid more serious problems in the future.

EDUCATION AND OUTREACH

Recent Activities

During the month of April, more than 1000 students, teachers, and members of the general public participated in Sanford Lab Education and Outreach programs, and the numbers continued into May.

"This time of year is always the high season for student field trips," said Education and Outreach Director Ben Sayler. Eighty-eight students and 10 teachers made the 50-mile trip from Knollwood Elementary School in Rapid City to participate in Education and Outreach activities and take part in hoist room tours. In May, 80 middle schoolers from Belle Fourche, SD visited Sanford Lab to design and construct their own working hoists in mini-shafts (shown in Figure 7).

Figure 7: Education Director Ben Sayler works with students from Belle Fourche Middle School during a hoist-construction exercise

The Education Department also participated in programs at the Homestake Opera House and the Homestake Visitor Center in Lead, and they worked

with the Communications Department to arrange videoconferences between students on the Lab surface and scientists underground. This included sessions for science students from Wall, SD (shown in Figure 8), and from Jasper County High School in Georgia.

Figure 8: Students visiting from Wall, SD talk with LUX physicist Richard Ott and Laboratory Support Scientist Mark Hanhardt (shown on the screen from the 4850 Level) (Matt)

Career days are also held in spring, and the Education Department coordinated with other Sanford Lab staff such as Project Controls Analyst Pam Hamilton to speak with Rapid City middle schoolers, and Brown University physicist James Verbus of the LUX experiment, who visited Spearfish.

Some of the programs are a bit smaller. For example, seven students from the Crow Creek Reservation in South Dakota visited Sanford Lab. On another day, six students visited from Black Hills Christian Academy. Other events were held for educators, including an in-service for Lead-Deadwood teachers, and an underground tour for officers of the Associated School Boards of South Dakota.

Black Hills State University intern Anna Hafele joined the Education just in time for the rush. One of her main duties will be compiling statistics from more than 1,000 evaluation forms filled out by participants.

Brown Bag seminar

On April 24, Lead-Deadwood High School senior Derek Morrison gave a presentation on the Sanford Lab water treatment plant. For a senior year project, he designed a scale model filter for his research on the water treatment plant, and worked with Sanford Lab Treatment Plant Operator Jackson Pahl, water-treatment consultant Jim Whitlock, and Environmental Manager John Scheetz. Derek plans to attend South Dakota School of Mines in the fall, where he will major in metallurgical engineering.

ENVIRONMENT, HEALTH & SAFETY

Picnic Safety

- Potato or macaroni salads or any food with mayonnaise should be kept chilled. Bring an insulated cooler with plenty of ice and frozen gel packs.
- Cut melons need to be kept cold to avoid bacteria, such as *salmonella.*
- Wrap hot food in towels and thoroughly cook all food such as hamburger patties or hot dogs.
- Keep it simple: make a picnic of bread, hard cheese, and wine.

If you are visiting South Dakota, contact (605) 722-0002 for road closure and weather information.

STAFF NEWS

Amity Harlan has been hired at SURF as the new receptionist at the main front desk. She grew up in Lead, and the Homestake mine has always been a part of her life because many in her family were employed by the mine. She has always been interested in science and research, so she completed a BS in Environmental Physical Science at Black Hills State University. Her favorite subjects are Geology and Physics. She has presented undergraduate studies for the South Dakota NASA Space Consortium via DUSEL, the Geological Society of America, and the National Conference for Undergraduate Research. After graduation, she worked for the National Forest Service and State Forestry performing Hydrologic studies and mountain pine beetle management. She also worked on experiments at *Blue Sugars Corporation*, a chemical lab in Rapid City, which focused on second-generation ethanol production. In her free time, Amity loves the outdoors and spends her time camping, hiking, and snowboarding. Inside,

she likes to participate in roller derby activities and skates with the *Madhouse Madams of Spearfish* (shown in figure 9).

Figure 9: Amity Harlan in roller derby

SURF also has three new summer interns:
Education Department: Anna Hafele, Black Hills State University (BHSU) biology major with physics interests
Science Department: Ashley Wingert, BHSU chemistry-biology major
Engineering Department: Bennett Prosser, South Dakota School of Mines & Technology
(More on their research in future issues)

UPCOMING CONFERENCES AND WORKSHOPS

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/

CETUP* workshop, Lead/Deadwood Middle School, Lead, South Dakota. June 24-July 26, 2013. The CETUP* 2013 workshop will address questions in physics, astrophysics, geosciences, and geomicrobiology.
http://www.dsu.edu/research/cetup/index.aspx

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

DPF 2013, APS Division of Particles and Fields Meeting, UCSC, Santa Cruz, CA. August 13-17, 2013.
http://www.aps.org/units/dpf/meetings/meeting.cfm?name=DPF13

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 contact Ryan Martin, RDMartin@lbl.gov

JOBS

Reader/Senior Lecturer in Physics, University of Liverpool, U.K. Faculty of Science & Engineering, School of Physical Sciences. Deadline: 6/21/13. Prof. Christos Touramanis, c.touramanis@liv.ac.uk.
http://www.liv.ac.uk/working/job_vacancies/academic/a-583108/

Postdoc Fellowship, CEA Saclay, France. Research related to search for rare events with bolometric detectors. Experimental physics, LUMINEU project. Deadline 4/30/13. Martin Loidl, martin.loidl@cea.fr.

Postdoctoral position, Max-Planck-Institut, Munich. Work with the CRESST experiment on dark matter search at Gran Sasso lab. Deadline 5/15/13. Info: Dr. Franz Pröbst, proebst@mpp.mpg.de. Apply: Sybille Rodriguez, MPI, Föhringer Ring 6, D-80805, München. rodi@mpp.mpg.de.

Two Faculty positions, South Dakota School of Mines and Technology, Rapid City. Physics Dept. is establishing a new PhD program. Research in particle/astroparticle physics, nuclear physics, or nuclear astrophysics related to SURF experiments. Job # 0005390, 0005391. Review begins 5/10/13.
https://yourfuture.sdbor.edu/applicants/jsp/shared/frameset/Frameset.jsp?time=1359677906174

Postdoctoral Researcher, Case Western Reserve University, Cleveland, Ohio. Work on LUX and LZ program in the Dark Matter Group led by Profs. Tom Shutt and Dan Akerib. Deadline: 5/15/13. LUXLZ_postdoc@phys.cwru.edu.

Postdoctoral Researcher, LLNL, Livermore. Research in Experimental Nuclear Physics (ENP) Group/Nuclear and High Energy Physics. Support of CUORE. Nicholas Scielzo (scielzo1@llnl.gov)
https://careers-prd.llnl.gov/psp/careers/EMPLOYEE/HRMS/c/HRS_HRAM.HRS_CE.GBL?Page=HRS_CE_JOB_DTL&Action=A&JobOpeningId=11017&SiteId=1&PostingSeq=1

Postdoctoral Researcher, Experimental Astroparticle Physics, IU South Bend, IN. Work on COUPP direct dark matter search experiment. Prof. Ilan Levine, ilevine@iusb.edu. Dept. of Physics & Astronomy, IUSB, 1700 Mishawaka Ave., South Bend, IN, 46634.
https://www.iusb.edu/academic-affairs/searches.shtml.php - postdoc

Tenure track faculty position at University of South Dakota. Background in theoretical/ computational physics and research including dark matter searches, neutrino experiments, or materials science focused on detectors in an underground environment. Job # 0005098.
https://yourfuture.sdbor.edu

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Contributors: Kevin Lesko; Bill Harlan (Sanford Lab local news); Peggy Norris, Ben Sayler (Education and Outreach)

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