

Dear SURF Readers,

Welcome to the August 2015 Sanford Underground Research Facility (SURF) monthly newsletter. The newsletter is posted online; a pdf copy is available as well. You can read recent and archived newsletters at our website -- 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

October 13-14: LZ EHS Review, Lead, SD
October 15: LZ Infrastructure Review, Lead, SD

October 28-30: LBNF CD3a Directors Review, Batavia, IL

KISMET: A New Geoscience Research Facility at SURF

Earth scientists from several national laboratories and three universities have begun work on a \$1.25M project to develop a new facility at SURF on the Davis Campus 4850 Level for research on permeability enhancement and induced seismicity in crystalline rock. Under the name KISMET, which stands for permeability (k) and Induced Seismicity Management for Energy Technologies, the facility will be located in the west ventilation drift in Poorman Schist (Figure 1).

The project will drill and core a five-spot pattern of 50-meter-deep boreholes into the floor of the drift along the east rib. The central borehole will be used for fracture stimulation while the outer four boreholes will be used for continuous active source seismic monitoring (CASSM) and electrical resistance tomography (ERT). Additional passive seismic monitoring will be carried out at other locations at SURF yet to be determined. The project will continue through early 2017, with the bulk of the fieldwork to take place in 2016.

Hydraulic fractures in geothermal reservoirs are generally controlled by a combination of the local stress field and rock properties, such as foliation patterns and existing fractures. The Poorman Schist at the KISMET site is foliated, and this rock texture is

expected to influence hydraulic fractures. The goal of the project is to carry out fracture stimulation of the center borehole while monitoring the fracturing process in real time. Monitoring data and associated interpretation will be available to the operators as feedback for use in controlling fracturing. Extensive pre-test characterization of stress, both locally and more widely at SURF will be carried out, along with stress modeling and interpretation. Permeability will be tested before and after the stimulation by water-injection testing.



Figure 1: The KISMET site in the SURF west ventilation drift with (left to right) Pat Dobson (LBNL), Bill Roggenthen (SDSMT), and Curt Oldenburg (LBNL)

The fieldwork will be complemented by a lab component of rock characterization, including seismic wave speed and electrical resistivity measurements critical for interpreting the CASSM and ERT monitoring, and mechanical properties for interpreting stress measurements. Results of research at KISMET will find their most direct application in the area of Enhanced Geothermal Systems (EGS), a current emphasis for development of geothermal energy technology. Passive monitoring of the microseismicity arising from KISMET activities will be used to understand induced seismicity in a variety of fluid injection applications including geologic carbon sequestration and oil and gas fluid disposal.

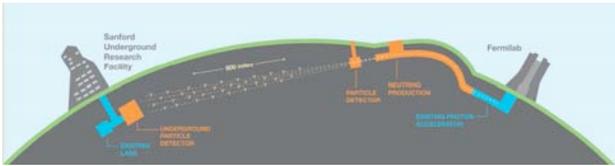


The U.S. DOE is funding LBNL as the lead on the KISMET project, one of several projects under its Subsurface Technology and Engineering Research (SubTER) Crosscut Initiative. Susan

Hubbard, of the LBNL Earth Sciences Division, is co-chair of the subTER team. SubTER projects are aimed at addressing challenges shared across subsurface energy technologies in the areas of wellbore integrity, stress and induced seismicity, permeability control, and new subsurface signals. SubTER funding currently comes from the U.S. DOE offices responsible for Oil & Gas, Carbon Capture and Storage, Nuclear energy, and Geothermal energy. More on this exciting new project will appear in future issues of the SURF newsletter!

To read more about SubTER:
<http://esd1.lbl.gov/research/projects/subter/index.html>

DUNE/ LBNF Critical Decision-1 Review



In mid-July, the DOE Critical Decision 1 (CD-1) review of the DUNE/LBNF project took place at Fermilab (FNAL). Steve Meador, Director of Office of Project Assessment at the DOE Office of Science chaired the reviewer team, with Jim Siegrist and Mike Procaro from the DOE Office of High Energy Physics as observers.

The experiment is the largest new initiative at Fermilab since the Tevatron shut down in 2011, and would be the first truly international megascience project hosted in the United States. It is also the largest initiative at Sanford Lab. The proposed LBNF/DUNE experiment would fire a beam of neutrinos from Fermilab near Chicago, Illinois to detectors underground at Sanford Lab.

LBNF project manager Elaine McCluskey, DUNE technical coordinator Eric James (both FNAL Neutrino Division), DUNE spokespersons André Rubbia (ETH, Zurich, Switzerland) and Mark Thomson (Cambridge, England) led the project team's presentation, along with DUNE resource coordinator Chang Kee Jung (Stonybrook, USA). Also participating were Sergio Bertolucci and Marzio Nessi (both CERN). A contingent from the South Dakota Science and Technology Authority (SDSTA) was led by LBNF far-site project manager Mike Headley, its Executive Director.

At the "closeout" session, overall responses from the reviewers were positive. Expecting a favorable outcome from DOE, the project team is preparing for the next step in the complex review process to allow construction to start at SURF.

To see slides from the recent DUNE FNAL Director's CD1-refresh review:

<http://www.fnal.gov/directorate/OPMO/Projects/LBNF-DUNE/DOERev/20150714/LBNF%20DUNE%20Project%20CD-1R%20Closeout.pdf>



In Memoriam: Dr. Zbigniew "Ziggy" Hladysz - 1947-2015

Dr. Zbigniew "Ziggy" Hladysz, was born in 1947 in Mikolow, Poland and spent his early years in Poland where he graduated from Politechnika Slaska (Engineering University) with a Master's Degree in Mining Engineering. He worked at the Glowny Institut Gornictwa (Central Mining Institute) in Katowice, where he obtained his doctorate degree in rock mechanics. He moved to the United States with his wife and family in 1981. In that same year, he was offered a professorship at the South Dakota School of Mines and Technology (SDSMT), and continued to work as an educator until 2014, sharing his knowledge and experience with the next generation of young engineers, leaving an indelible mark on hundreds of students. In addition to teaching he was involved in many other projects, in particular SURF (Sanford Underground Research Facility) in Lead where he helped design the underground structure.

Dr. Hladysz became involved with SURF in early 2009, providing his geotechnical expertise throughout various phases of SURF underground construction. He was part of the first group performing inspections of the underground site, making presentations to the public, and refining the conceptual design of the Davis Campus 4850 Level, resulting in a safer and more realistic approach to dimensioning and spacing of excavations, particularly the large cavities. As Geotechnical Project Engineer, in 2010 he was part of the team using the Maptex I-Site 8800 laser to create a virtual map to provide remote access to the 4850 Level

Davis Campus. The I-Site 8800 used an infrared laser and an ultra-high resolution, 40 mega-pixel camera to create a virtual texture of the cavern. The laser created a vector map (a detailed mathematical model of the cavern). Hladysz used laser scans to create accurate models of the entire underground campus, with the base scan supplementing manual mapping and searching for fractures, joints, or other parameters of the geology.



Figure 2: In this photo from June 2010, Ziggy Hladysz describes the planned 4850 Level campus to then-Rapid City High School student Sophia Elia (Elia is currently a student at UC Berkeley)

In 2013, Maptek and SDSMT created the Ziggy Hladysz Maptek \$280,000 Endowment in honor of the recently-retired Hladysz, noting his long-time professorship and mentoring of mining and engineering students. The endowment, managed by the SDSMT Foundation, is used for Mining Engineering Department scholarships and to maintain the Maptek Advanced Mine Design Center. The lab, which was unveiled in 2008, serves about 200 mining, engineering and geology students and is home to 25 computers equipped with Maptek Vulcan geological modeling and mine planning software. Maptek was used to map the geology and layout of the Sanford Lab underground.

His enthusiasm and humor will be greatly missed by everyone who knew him. A memorial has been established to benefit the skateboard park in Rapid City. Osheim & Schmidt Funeral Home of Rapid City is hosting his online guest register at www.osheimschmidt.com.

BGE Workshops

Biology, geosciences, and engineering (BGE) research is being conducted worldwide in many underground locations. One effort to bring this group of scientists together took place in May 2015, with

the 4th Underground Research Laboratory (URL) Workshop, held in Montreal. Previous workshops have been hosted in Beijing, Lisbon, and Johannesburg. These URL workshops, held every four years, are associated with the 10th-13th Congresses of the International Society for Rock Mechanics (ISRM), respectively. The ISRM Congresses are the premier venues for the rock mechanics and geotechnical engineering community, including civil, mining, and petroleum engineering.



Figure 3: Field visit to SNOLab at Sudbury before the 4th URL workshop in Montreal

Prior to the workshop, ten participants from China, France, Canada, and the United States visited SNOLab's CEMI (Center for Excellence in Mining Innovation) on May 7-8. They were interested in large excavations in Deep Underground Labs (DULs), especially the applicability of the experiences of design and excavation of the CRYOPIT at SNOLab for other DULs (Figure 3).

The ongoing expansion of the China JinPing Lab (CJPL) and the physics and multi-disciplinary experiments in four European DULs, together with SNOLab and SURF programs, were the main topics presented in two morning sessions of the workshop. In addition to Dark Matter (DM) searches, the Charge Parity Violation (CPV) was presented as one of the motivations in conducting long-baseline experiments such as T2K in Japan and the newly-named DUNE/LBNF at Fermilab and SURF.

Attendees at the fourth URL workshop were very interested in the discussion of various physics experiments. The first afternoon sessions focused mainly on the radioactive waste URLs' recent advances, including Belgium's newly-commissioned heater experiment, Finland's recently completed looped facility, and Germany's salt dome testing

results. A second afternoon session covered CEMI's ultra-deep mining network, use of URLs for hydraulic fracturing (HF) experiments with supersaturated and undersaturated gases, fault zones testing in two French and one Swiss URLs, and the area-specific URL in China. In the final session, discussion and presentations centered on the further activities of interacting and networking among URLs and DULs. Underground studies were also discussed. Following the workshop, a meeting on microbiology sampling was held on May 15 at the University of Toronto.

Presentation files are posted at:
<https://indico.cern.ch/event/401223/>

REPORTS/PAPERS AVAILABLE

[The Sanford Underground Research Facility at Homestake \(SURF\)](#). (K.T. Lesko, Phys.Procedia 61 (2015) 542-551.)

Results from the LUX Dark Matter Experiment. (LUX Collaboration, Markus Horn *et al.* Nucl.Instrum.Meth. A784 (2015) 504-507.)

[P5 report \(Print quality\)](#) *The full Particle Physics Project Prioritization Panel report as accepted by the High Energy Physics Advisory Committee*

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

Symmetry: [Testing the nature of neutrinos](#) (Lauren Biron, August 11)
[Miraculous WIMPs](#) (Manuel Gnida, July 15)

Fermilab Today: [Testing the nature of neutrinos](#) (Lauren Biron, August 13)

Phys.org: [New theory—if we want to detect dark matter we might need a different approach](#) (Staff, August 20) (Also in [The Archaeology News Network](#), University of Southern Denmark)

Berkeley Lab News Center: [Notes from the Particle Physics Underground](#) (Kate Greene, August 3) (Also in [Fermilab Today](#), August 5)

Imperial College London news: [The hunt for the universe's missing matter](#) (Andrew Czyzewski, August 10)

Myscience.org: [The hunt for the universe's missing matter](#) (August 10)

Medium: [A Tale of Two Neutrino Labs](#) (Rep. Randy Hultgren, August 11)

Yankton Daily Press & Dakotan: [Public University Research Grants Stimulate Economic Development](#) (August 5)

Spring Valley Tribune: [Kingsland officials, teachers explore underground research lab](#) (Gretchen Mensink Lovejoy, August 11)

South Dakota Public Broadcasting: [Underground Geology with Tom Campbell](#) (Cara Hetland, August 14)

KEVN TV: [Sculpture dedicated to Dr. Ray Davis at the Sanford Lab Homestake Visitor Center](#) (Eliana Sheriff, August 26)

[Black Hills State University ready for new school year](#) (Eliana Sheriff, August 19)

[BHSU taking education opportunities to new depths](#) (Jaclyn Seymour, July 31)

KOTA TV: [Lead dedicates sculpture to scientist Dr. Ray Davis](#) (Staff, August 27)

[Mines students complete summer internships](#) (Staff, August 21)

KELO TV: [Lead Middle School Hosts International Physicists](#) (Kevin Woster, July 18)

South Dakota War College: [Noem Urges Administration to Prioritize Sanford Lab Research](#) (August 11)

Rapid City Journal: [Real world experiences pay off for hundreds of Mines students](#) (August 23)

[Mines' research funded by regents' grant could boost economy](#) (Emily Niebrugge, August 7)

*Black Hills Pioneer: [Davis Tribute Sculpture Dedicated](#) (Jaci Conrad Pearson, August 27)
[Davis tribute sculpture dedication Wednesday](#) (Staff, August 22)
[Can county roads support 800,000 tons of Sanford Lab rock removal?](#) (Adam Hurlburt, July 23)*

DURA News

To comment on DURA, please contact its 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 update

Two significant milestones were reached in July with the Ross Shaft rehab, and the project now stands at 3014.6' of shaft rehabilitation. In addition, the project has removed its 500th old steel set from the shaft. To reach these milestones, seven new sets of steel were installed in July. Sets 174B through 180E were installed over a span of 114.8'.



Figure 4: Ross Shaft: Removing concrete liner to allow for minimum 2" buffer



Figure 5: Visual representation of data from a 3-D laser scan of the Ross Shaft

All four sides of the shaft are now lined with concrete that was installed during the operating Homestake Mining days as a form of ground control. The concrete shaft walls have squeezed the old steel over the past decades, and also impede the installation of new steel. As a result, certain sections of this concrete liner will be removed to allow for steel installation and provide a minimum of 2" of creep over the projected 50-year life of the shaft (Figures 4-5).



Info on Travel to Lead

The second section of Main Street in Lead will be under construction until mid-September, and detours will be in place. Please follow this link to see the map of Main Street and to locate the detours for traveling to and from Sanford Lab:

<http://www.highway85lead.com/traffic>

EDUCATION AND OUTREACH

CETUP*

During July, more than 150 scientists from around the globe gathered at Lead-Deadwood Middle School over a five-week period to discuss theoretical physics. The event was part of the fifth annual Center for Theoretical Underground Physics and Related Areas (CETUP*) conference led by Barbara Szczerbinska, CETUP* organizer and Associate Professor of Physics at Dakota State University.

Underground visit by educators

In early August, high school instructors and officials from Kingsland High School (Spring Valley, Minnesota) took an underground tour at Sanford Lab. Kingsland's superintendent John McDonald began a relationship with Sanford Lab two years ago as part of an effort to bring 'real world' applications into their engineering curriculum. Kingsland School District uses *Project Lead the Way* Engineering curriculum at all grade levels. A slide presentation on SURF's underground research was presented at their July school board meeting with an eye to collaborative efforts for school districts in the future. Touring SURF gave teachers a chance to bring back simple lessons such as magnetism and magnets to elementary students that might lead to later interest in more advanced questions about the universe. In

building partnerships with research facilities, Kingsland teachers and administrators hope to continue to develop and expand scientific programs into the classroom.

Report from Sanford Lab intern



During the summer months, Carissa Hauck was an intern with the Environmental Health and Safety Department at Sanford Lab. As a senior at Black Hills State University, she was able to transfer existing training components into modules she developed for online training. The modules have video scenarios and embedded quizzes that allow people to do their training anywhere. The modules will be easy to use like a PowerPoint presentation. Hauck works at BHSU doing similar work as she did at SURF to help create learning programs for students.

ENVIRONMENT, HEALTH & SAFETY



Back-to-School Driving Safety

- Be on the lookout for school zone signals and always obey the speed limit.
- Watch for children near schools, bus stops, sidewalks, streets, and school parking lots.
- When driving behind a bus, allow a greater following distance than with a car. It is illegal in all 50 states to pass a school bus that has stopped to load or unload children.

UPCOMING CONFERENCES AND WORKSHOPS

TAUP2015, XIV International Conference on Topics in Astroparticle and Underground Physics, Torino, Italy, September 7-11. Topics include recent experimental and theoretical developments in astroparticle physics.
<http://taup2015.to.infn.it/>

Workshop on Calibration of low energy particle detectors, Kavli Institute, University of Chicago, September 23-25. Presented talks include detector technologies: scintillating crystals, ionization and

phonon solid state detectors.

<http://kicp-workshops.uchicago.edu/2015-lowecal/>

APS Division of Nuclear Physics Annual Fall Meeting, Santa Fe, New Mexico, October 28-31. Travel and lodging awards granted to selected qualified students.

<http://www.lanl.gov/conferences/dnp-2015/>

NN15, International workshop on Next Generation Nucleon Decay and Neutrino Detectors and Unification Day 2 Workshop (UD2), Stony Brook, New York, October 28-31. Funds available for grad students and postdocs.

<https://www.bnl.gov/nnn2015/index.php>

NuINT 2015, workshop on Neutrino-Nucleus Interactions in the Few-GeV Region, Osaka, Japan, November 16-21.

<http://indico.ipmu.jp/indico/conferenceDisplay.py?ovw=True&confid=46>

Conferences for Undergraduate Women in Physics, Rapid City, South Dakota area, January 15-17, 2016. If you are associated with any of the physics experiments taking place at Sanford Lab or planned for the future, and wish to be involved in the planning process for the 2016 conference, please contact Peggy Norris at pnorris@sanfordlab.org.



JOBS

Research Scientist, SURF, Lead, South Dakota. Support experiments at SURF by serving as liaison between science experiments and SURF operations. Report to Science Director and take leading role in participating in and supporting one or more scientific experiments. Deadline: 8/31/15.
<http://www.sanfordlab.org/careers>

Mechanical Engineer, SURF. Work with SURF Engineering, Science, Underground Access, and Facility Infrastructure Departments to facilitate design development and integration of new research facilities. Deadline: 9/7/15.
www.sanfordlab.org/careers

Chamberlain Postdoctoral Fellows (2016), Lawrence Berkeley National Lab. Multiple openings in experimental particle physics and cosmology. Applicants will also be considered for

other experimental postdoc positions at LBNL.
Contact: Sapana Kanakia, skanakia@lbl.gov.
Deadline: 10/15/15.

<https://academicjobsonline.org/ajo/jobs/5816>

Lecturer in Experimental Astroparticle Physics, Imperial College, London. Candidate will also conduct research in Dark Matter, strengthen LZ experiment effort. Job ref: NS2015148PE. Deadline: 9/31/15. Queries: Paul Dauncey, p.dauncey@imperial.ac.uk, Paula Brown, paula.brown@imperial.ac.uk
<http://www3.imperial.ac.uk/highenergyphysics/about/jobs>

Research Associate, SLAC. Work with nEXO Collaboration, Neutrinoless Double Beta Decay. Contact: P.C. Rowson, rowson@slac.stanford.edu, G. Gratta, gratta@stanford.edu. Deadline: 9/30/15.
<https://academicjobsonline.org/ajo/jobs/5710>

Postdoctoral position, University of Alabama. Research on the LZ experiment with lead role in development of software tools for online and offline data processing, event reconstruction, and database management. Deadline: 8/16/15. Contact Jerry Busenitz, busenitz@ua.edu
<http://facultyjobs.ua.edu/postings/36528>

Nuclear Physics Postdoc, LANL. Research with Weak Interactions/ Astrophysics Team. Vacancy #: IRC41796. Contact: Steve Elliott, elliotts@lanl.gov / Keith Rielage, rielagek@lanl.gov.
<https://jobs.lanl.gov>

Postdoctoral Researcher, LLNL. Work with team to develop and execute nuclear data focused fission-TCP experiment. Job ID: 100107. Contact: Brandon Seilhan, seilhan3@llnl.gov.
<https://careers.llnl.gov/>

Postdoctoral position, Duke University. Research in experimental neutrino physics with Super-Kamiokande in Japan; also T2K, COHERENT, DUNE and other projects. Deadline 9/12/15. Contact: Kate Scholberg, schol@phy.duke.edu; Chris Walter, chris.walter@duke.edu
<http://academicjobsonline.org/ajo/jobs/5654>

High Energy and Nuclear Physics Consultant, NERSC, LBNL. Will consider candidates at Computer Systems Engineer 3 or 4 levels. Job # 81045.
<https://lbl.taleo.net/careersection/2/jobdetail.ftl?lang=en&job=81045>

Postdoctoral position, Northwestern University. Research in Dark Matter and Neutrino Physics in group led by Prof. Enectali Figueroa-Feliciano. SuperCDMS second-generation experiment/search for dark matter in the form of WIMPs. Submit to: postdoc@figueroagroup.nu
<https://inspirehep.net/record/1365222>

Postdoctoral position, Northwestern University. Dark Matter Search with Micro-X Rocket, to join the group of Prof. Enectali Figueroa-Feliciano. Deadline: 12/31/15. Submit to: postdoc@figueroagroup.nu
<https://inspirehep.net/record/1365224>

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Photo Credits: Fig. 1: Curtis Oldenburg; Fig. 2: Bill Harlan; Fig. 3: Joe Wang; Fig. 4: Will McElroy; Fig. 5: Matt Kapust

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