

Dear SURF Readers,

Welcome to the June 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

**June 28: DOE / NSF Site Visit – Lead, South Dakota**

**July 14: Neutrino Day – Lead, South Dakota**

## Davis Campus Dedication

On May 30, South Dakota Governor Dennis Daugaard hosted a dedication ceremony to celebrate the official opening of the Davis Campus at the Sanford Underground Research Facility (SURF) in Lead, South Dakota. Nearly 100 people attended. The event included a morning underground tour for three groups of approximately 60 people: scientists from various universities and national research laboratories, officials from South Dakota and the Department of Energy (DOE), and 15 reporters from the local and national media. Some members of the tour can be seen in Figure 1. Amber Hunt, AP news editor for North and South Dakota produced a story and a video that were picked up around the country in such places as *The Washington Post*, *The Minneapolis-Star Tribune*, and *CBS News Moneywatch*. (Please see SURF in the News on page 3 for some of their stories.) The underground tour was followed with a luncheon, prepared by Cheyenne Crossing, in the Yates Education Building. To view a video of the May 30 dedication ceremony on YouTube:

<http://www.youtube.com/watch?v=9QR-CzuJbxY>



*Figure 1: From left: Fermilab Physicist Boris Kayser, Fermilab Deputy Director Young-Kee Kim, SD Office of Economic Development Commissioner Pat Costello, SD Gov. Dennis Daugaard, T. Denny Sanford, former SD Gov. Mike Rounds, Andrew Davis (son of Ray Davis), LBNL Associate Director James Symons, Susan Nimori (Davis's daughter-in-law) and DOE HEP Associate Director James Siegrist*

Speaking at the dedication ceremony, Governor Daugaard praised former Governor Mike Rounds for his dedication to the project. One of the many tasks that Rounds took on included negotiations with the Homestake Mining Co. to settle liability issues so the gold mine could transfer to the State of South Dakota after mining operations ended in 2003. Gov. Rounds ensured that funds needed to get the project off the ground came through from various government agencies.

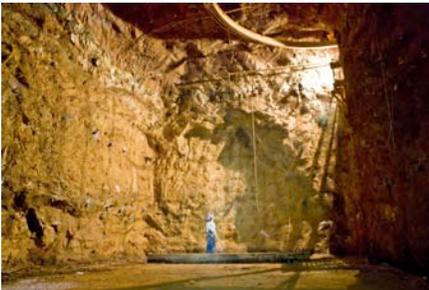
Speakers also included DOE's Associate Director of the Office of High Energy Physics (HEP) James Siegrist and Sanford Lab Principal Investigator Kevin Lesko.

At the luncheon, philanthropist T. Denny Sanford, and Anna Davis, the widow of the late Nobel Laureate Ray Davis were warmly welcomed, and their significant contributions to the Lab's development gratefully acknowledged. Sanford donated \$70 million to the Lab; Ray Davis carried out extensive neutrino research in the old Homestake mine, for which he received the shared 2002 Nobel Prize in Physics. Anna Davis was presented with a plaque that contains a piece of the neutrino experiment designed by her husband. That experiment was torn down to make way for the LUX water tank shown in Figure 2.



*Figure 2: Anna Davis displays replica of her husband's Nobel Prize. Behind her, where the Davis experiment once stood, is the water tank that will hold the LUX dark-matter detector*

T. Denny Sanford had not been at the 4850 Level underground since September 2010, and others were amazed at the progression from an abandoned gold mine of rock walls and dirt floors to a cutting-edge scientific laboratory. In the past, the space was dark, moist, and humid, with water dripping from overhead wooden beams, as shown in some September 2009 photos in Figures 3 and 4.



*Figure 3: September 2009 photo – Sanford Lab Infrastructure Technician Luke Scott surveys the empty Davis Cavern on the 4850 Level. Scott and his team had removed tons of steel from the cavern in summer 2009, including the 110,000-gallon tank that was part of the neutrino detector designed by Ray Davis.*



*Figure 4: September 2009 photo at the 4850 Level - Sanford Lab Underground Operations Foreman Jack Stratton behind the 20-foot boom of the jumbo drill. Note the watery floor!*

Today, the ceilings consist of acoustic tiles or overhead conduits wrapped in foil, the walls are of cinder block, and the floors are steel grids and painted concrete (see Figures 5 and 6). The laboratory contains about 1800 square feet and two stories for the LUX dark-matter detector, and approximately 8000 square feet for the MAJORANA DEMONSTRATOR neutrinoless double-beta decay experiment. The space contains LUX's 25-foot diameter, 20-foot tall water tank, and the necessary infrastructure to function as a modern scientific laboratory, e.g., HVAC and ultra-high speed Internet access systems.



*Figure 5: May 2012 photo of the Transition area*



*Figure 6: May 2012 photo of the Transition area - Entrance to the MAJORANA DEMONSTRATOR machine shop on the left*

Now that the space is ready, the LUX dark-matter detector and the MAJORANA DEMONSTRATOR experiments are currently in the process of being installed at the Davis Campus. The LUX detector is scheduled to be operating later this year.

“The direct impact on South Dakota is that this is absolutely a top flight facility in the world,” LUX experiment co-founder and physics professor Tom Shutt (Case Western Reserve University) spoke in an interview with reporters. “We’re going to have the most sensitive worldwide experiment in this sort of competitive field.”

After only four days of operation underground, the LUX detector will surpass the sensitivity of all previous dark-matter search experiments, said Brown University physics professor Rick Gaitskell, who co-directs LUX with Shutt.

In the evening, Fermilab physicist Boris Kayser gave a talk, "Neutrinos Get Under Your Skin," at Lead's Historic Homestake Opera House. Speaking to a full house, he gave a humorous presentation at a layperson's level regarding the Homestake mine's historic role in neutrino research. The event, open to the general public, was sponsored by *Ainsworth-Benning Construction* and the Lead Chamber of Commerce who also hosted a social hour with a slideshow of Sanford Lab's evolution. (The century-year old building commissioned by Phoebe Apperson Hearst suffered from a serious fire a few decades ago, but it is slowly being renovated as funds permit. To read more about the Opera House: <http://www.leadoperahouse.org/>)

**SURF: Supplement Articles**

The second in a 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**

*BBC News:* [Searching for dark matter in the Homestake Gold Mine](#) (Matt Danzico, May 30) – Includes a BBC-produced video

*Washington Post:* [New underground lab turns S. Dakota gold town into scientific hub in search for 'dark matter'](#) (Associated Press, May 30)

*LBNL News Center:* [Advancing Underground Science at South Dakota's Sanford Lab](#) (Paul Preuss, June 7) – With slideshow

*Symmetrybreaking.com:* [Underground science lab dedicated deep in the Black Hills](#) (Paul Preuss, May 31)

*Black Hills Pioneer:* [Deep Impact](#) (May 30 – Several articles by Wendy Pitlick - including an 8-page Special Report (paper)

[Sanford Lab economic impact slow but significant](#)  
[Sanford Lab education impact spans multiple ages, levels](#)

[New digs!](#) (May 31)

[Governor confident in future of Sanford Lab](#) (May 30)

*Rapid City Journal:* [Science lab transforms former gold mine](#) (George Ledbetter, June 5)

[Homestake lab open for business](#) (Editorial, June 3)

[Viewing project he'll rarely see](#) (Kevin Woster, June 3)

[Davis Campus dedication moves Sanford underground laboratory forward in science](#) (Kevin Woster, May 31)

Lab Manager Magazine: [Science Underground: Going to Great Depths](#) (May 18)

Phys.org.news: [Searching for dark matter](#) (David Orenstein, May 25)

[Lying in wait for WIMPs](#) (Paul Preuss, May 23)

[MAJORANA, the search for the most elusive neutrino of all](#) (Paul Preuss, May 17)

R&D Magazine: [Deep underground, LUX lies in wait for WIMPs](#) (Paul Preuss, May 24)

*Fermilab Today:* [Planning is everything](#) (Pier Oddone, June 5)

*Slate:* [The Dark-Matter Ages](#) (Lawrence Krauss, June 14)

KOTA, KOTA Territory: [Sanford Underground Lab opens with VIP tour](#) (May 30) – Includes a video

SDPB.org: Dakota midday radio live webcast with Will McElroy, Sion Hanson and Bob Webb (June 5, noon)

*ArgusLeader.com:* [Quick thumbs up for zoo, lab, Guard unit](#) (June 3)

For twitter updates see: [www.sanfordlab.org](http://www.sanfordlab.org)

**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](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](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](http://science.energy.gov/~media/np/pdf/Review_of_Underground_Science_Report_Final.pdf)

**SANFORD UNDERGROUND LABORATORY NEWS**

**Construction updates**

On May 17, the Yates Shaft was opened as the primary access to the Davis Campus, a quicker, easier entry for scientists, while the LUX and MAJORANA DEMONSTRATOR experiments are being installed. The reopening of the Yates also allows crews to begin replacing steel in the 5000-foot Ross Shaft.

The reopening of the Yates Shaft project with many different entities involved began in November 2008. *RCS Construction* refurbished the shaft itself, a process that lasted 18 months. Sanford Lab Operations Department staff designed and received delivery of a new conveyance (cage). *Heavy Constructors* built the tower outside the Yates headframe building as a safety measure to support the rope-dog safety system. Sanford Lab Operations Department installed the dog ropes—two 5200-foot steel ropes that run the length of the shaft.

As a preliminary for the May 30 Davis campus dedication ceremony (mentioned on page 1), on Sunday, May 27, local South Dakota officials rode the Yates Cage (Figure 7).



*Figure 7: Science Liaison Director Jaret Heise speaks to local dignitaries outside of the MAJORANA assembly area at the Davis Campus 4850 Level*

**LUX water tank**

At the beginning of June, another step in the construction process took place as the LUX water tank was lined with white reflective Tyvek. Nearly a mile of rock will shield the LUX dark-matter detector from cosmic radiation. To further shield LUX from possible sources of spurious events such as neutrons and photons from natural radioactive decay and cosmic-ray interactions in the surrounding rock, the LUX titanium detector will be contained within the large water tank (currently empty) shown in Figure 8. The water tank will be fitted at its periphery with photomultiplier tubes to detect the Cherenkov-effect light pulse produced in the water by penetrating cosmic-ray muons to veto, ie ignore, such potential background-causing events. (The Cherenkov effect is the production, along its path of a cone of light by a charged particle whose speed in a dielectric medium is greater than the speed of light in that substance,  $c/n$ , though still less than the vacuum light speed  $c$ .) The purpose of the Tyvek liner is to increase the light-collection efficiency.



*Figure 8: LUX scientists (L-R) Susanne Kyre and Dean White of UC Santa Barbara and Vic Gehman of Lawrence Berkeley Lab hang Tyvek liner in the LUX water tank at the 4850 Level*

Like Sanford Lab on Facebook (and also see Sanford Lab's Photo of the Day): <http://www.facebook.com/SURFatHomestake>

## EDUCATION AND OUTREACH

### Recent Activities

Upper elementary and secondary teachers from across South Dakota participated in recent professional development workshops at Sanford Lab.

A one-day workshop introduced 13 teachers to the 'Physics of Atomic Nuclei (PAN)' through a combination of lectures and hands-on activities. Teachers were presented with a historical overview of the evolution of atomic models, and short introductions to nuclear, particle and astro-physics. Activities included atomic spectroscopy, nuclear science, and cloud chambers.

Ten teachers who already had some familiarity with the content were invited to attend a week-long 'ePAN' workshop, which focused on online resources for introducing modern physics content into classrooms (shown in Figure 9). Teachers developed lesson plans utilizing online material to take back to their classrooms this school year. A few of the many Internet resources explored by teachers and presenters alike included:

- *PhET Interactive Simulations* (University of Colorado at Boulder) provides fun, interactive, research-based simulations of physical phenomena (<http://phet.colorado.edu>);
- *The Molecular Workbench* (from the Concord Consortium) is another site with good simulations of physical phenomena at the atomic and molecular scale (<http://workbench.concord.org>);
- *Quarked* (from University of Kansas) introduces elementary school students and their parents to the subatomic world through science-based games (<http://www.quarked.org>);
- *The ParticleAdventure* (from the Contemporary Physics Education Project) introduces older students to the subatomic world (<http://particleadventure.org>);
- *The CassiopeiaProject* (from Mudbrick Media Studios) provides high definition science-based animations on many topics, including the

standard model and cosmology ([www.cassiopeiaproject.com](http://www.cassiopeiaproject.com));

- *ASPIRE (Astrophysics Science Project Integrating Research and Education)* from University of Utah) has JAVA-based interactive on cosmic rays, the life cycles of stars and other topics (<http://sunshine.chpc.utah.edu/>).



*Figure 9: ePAN workshop participants tour the Hoist Room. From left: John Mcenelly (Chamberlain High School), Julie Dahl (BHSU/Sanford Lab), Peggy Norris (BHSU/Sanford Lab), Debby Hopkins (Tripp-Delmont School), Ann Hast (Rapid City West Middle School), Chad Ronish (Hill City High School), Deirdre Peck (Aberdeen Central High School), Maywin Thoreson (South Dakota Starbase), Lynn Arnold (Rapid Valley Elementary, Rapid City), James Stearns (Aberdeen Middle School), Steve Gabriel (Spearfish High School), Chuck Standen (Spearfish High School).*

## ENVIRONMENT, HEALTH & SAFETY



### Summer Pet Safety

- Pets can get sunburn too! Use pet sunscreen on possible affected areas such as the ear tips and nose.
- Never leave your pet in the car while you are gone, even with the windows rolled down. The sun can raise the temperature inside your car to 120°F within minutes.
- Refresh your pet's water bowl frequently, or add ice cubes to their water dish.
- If you will be traveling, have a trusted, reliable pet sitter look after your pet. If you take your pet with you, get them accustomed to their crate first. They should travel in a ventilated, shady crate with plenty of fresh water.

**Safety pages on Sanford Lab website:**

[www.sanfordlab.org](http://www.sanfordlab.org) - Use the left hand menu to open individual pages

**STAFF NEWS**



Joseph Gantos began his first day as SURF Environment, Health and Safety Director on May 21. Recently, he held a similar position as Executive Director with the National Renewable Energy Laboratory in Golden, Colorado. Gantos received his BS and MS degrees in Civil Engineering from Ohio State, as well as an MBA from West Texas A&M. He brings more than 15 years of experience in the environment, health and safety field. Originally from Beirut, Lebanon, Gantos has lived in the United States for 32 years. He looks forward to the unique challenges at SURF.

Joe and his wife Rosie just celebrated their 25<sup>th</sup> anniversary in January. Their daughter Gabrielle graduated from Wellesley last year and is currently working for Excel Energy in Denver. Their son David just finished his third year at Ohio State. Joe enjoys the outdoors, hiking, and jogging. He has participated in several marathons, the last full one in New York City.

A favorite quote: "Always focus on the front windshield and not the review mirror." – Colin Powell

*Welcome Joe!*

**UPCOMING EVENTS & ANNOUNCEMENTS**

**Conferences and Workshops**

**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**

**46<sup>th</sup> U.S. Rock Mechanics Geomechanics Symposium** - June 24-27, 2012, Chicago, IL.  
<http://www.armasymposium.org/>

**AAPG: Fundamental Controls on Flow in Carbonates** - July 8-13, 2012, Saint Cyr-Sur-Mer, Provence, France.  
<http://www.aapg.org/education/hedberg/france2012/>

**IWAA12: International Workshop on Accelerator Alignment** - September 10-14, 2012, Fermilab, Batavia, IL.  
<https://indico.fnal.gov/conflLogin.py?returnURL=https%3A%2F%2Findico.fnal.gov%2FconferenceDisplay.py%3FconfId%3D4712&confId=4712>

**NNN12: Next Generation Neutron Decay and Neutrino Detectors** - October 4-6, 2012, Fermilab, Batavia, IL.  
<http://www-ppd.fnal.gov/conf-w/FermilabSponsoredConferences.htm>

*Please send information* regarding upcoming meetings of interest or presentations from DURA members, as well as other related events to [Richard\\_Gaitskell@brown.edu](mailto:Richard_Gaitskell@brown.edu) or [jswang@lbl.gov](mailto:jswang@lbl.gov).



**JOBS**

**Postdoctoral position – IRFU/SPP (CEA-Saclay), in close collaboration with CSNSM (Orsay University).** Search for WIMPs with the EDELWEISS---III detectors. Eric Armengaud, IRFU/SPP, Bat 141, CEA Saclay 91191, Gif-sur-Yvette, France or [eric.armengaud@cea.fr](mailto:eric.armengaud@cea.fr)

**Postdoctoral Researcher position – 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](mailto:jmlink@vt.edu), Virginia Tech Physics Dept., 317 Robeson Hall, M/C 0435, Blacksburg, VA 24061. Job #0121584. <http://www.jobs.vt.edu>

**Postdoctoral position – LIP-Coimbra, Portugal.** Participate in LUX dark matter experiment in Lead,

## SURF MONTHLY NEWSLETTER

South Dakota. Also may involve teaching and course development at University of Coimbra, Portugal. Inquiries: [Isabel@coimbra.lip.pt](mailto:Isabel@coimbra.lip.pt). Applications: [Ricardo.caeiro@coimbra.lip.pt](mailto:Ricardo.caeiro@coimbra.lip.pt).

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**Photo/Graphic Credits:** Fig. 1: Steve Babbitt (Black Hills State University); Figs. 2,5,6: Roy Kaltschmidt (Lawrence Berkeley National Lab); Figs. 3-4: Bill Harlan; Figs. 7-9: Matt Kapust.

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