

**Dear SURF Readers,**

Welcome to the April 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 new website at [www.sanfordlab.org](http://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

**May 15-16: LZ SURF Infrastructure meeting – Lead, South Dakota**

**May 24-27: International Symposium (ISOUPS2013) – Pacific Grove, CA**

## New Physics Ph.D. Program in South Dakota

With one stroke of his pen, on March 26, Governor Dennis Daugaard (shown in Figure 1) removed South Dakota from its association with Vermont as one of only two states not to offer a Ph.D. in Physics. In signing next year's budget, he approved a \$1.9 million request from the South Dakota Board of Regents to launch the Physics Ph.D., which will be delivered cooperatively by the University of South Dakota and the South Dakota School of Mines and Technology (SDSMT). The budget allows each institution to hire four new tenure-track faculty, including some at the senior level, as well as providing generous funding support for twelve doctoral students at each institution. These state-funded assistantships will complement the grant-funded assistantships currently available to students enrolled in the master's programs at the two institutions, and will allow for a strong student cohort to be developed in South Dakota. The program will begin in Fall 2013 with an estimated 12 students, and expand up to 48 students over the next five years.

The Ph.D. in Physics will add to the significant investments already made by the State of South Dakota and the campuses in infrastructure improvements, which directly support research

projects planned for the Sanford Underground Research Facility.



*Figure 1: South Dakota Governor Dennis Daugaard signs budget to fund new Physics Ph.D. program*

The new degree program will also allow current South Dakota undergraduate and master's students (as shown in Figure 2) to continue to pursue the projects in which they are currently engaged at a level of sophistication and understanding commensurate with doctoral dissertations. The program opens up new avenues of cooperation with major collaborations and will increase South Dakota's national and international reputation in physics, while at the same time making physics faculty more competitive for external grant funding because of the availability of doctoral students, who may devote significant effort to research projects.



*Figure 2: Four University of South Dakota grad students work on a cryogenic distillation column*

## Planetarium show on dark matter

A group of universities, labs, and planetariums is currently producing an exciting, state-of-the-art planetarium show about the exploration of dark

matter, from the Big Bang and galaxies, to the LUX experiment and Large Hadron Collider.

Planetariums worldwide host audiences of more than 110 million people each year, and a large fraction of these are students. To present the show at the largest number of planetariums and to maximize the audience, the show will be distributed at no charge.

A primary goal of the program is to inspire and engage students and others with the amazing story that particles of dark matter created in the Big Bang are true relics of the beginning of the Universe. The planetarium show will bring the adventure of discovery to this large audience of students and the general public.

A dynamic and experienced team is producing this planetarium show. The team includes a Nobel Prize-winning cosmologist, an Academy Award-winning actress as narrator, an award-winning Hollywood scriptwriter, and a famous band member as composer (credits include *Apocalypse Now*, *The Twilight Zone*, and other films). Experts from seven planetariums in the US, Britain, and France are collaborating.

A one-minute preview segment has already been produced and shown in several planetariums, and audiences have been extremely enthusiastic about this segment. The draft segment was fully rendered for a planetarium dome, and as such was a demonstration of its creative and technical abilities. Comments included: “The planetarium managers at the museum were really ‘wowed’ by the clip,” and “The 40 seconds of [the] animation in a full dome was a great success.”

This educational experience will promote continued learning in science by demonstrating the excitement of frontier science. Associated efforts will include the development of both print and web-based materials, in collaboration with the *Adler Planetarium* in Chicago (a work still in progress). After release of the planetarium show, a flat-screen version will be released for use in lecture halls, theaters, the Web, and other venues.

The four executive producers (Kaushik De, Reinhard Schwienhorst, George Smoot, and Michael Barnett), director (Joao Pequenao) and producer/scriptwriter (Carey Ann Strelceki) recently met in January. After

reviewing many aspects of the script, they turned their attention to the already-filmed scenes at SURF (including LUX) by Jose Francisco Salgado of the *Adler Planetarium*.



*Figure 3: The animation group in Valencia in front of wall Post-its outlining the production. Chart on left outlines timing of the introductory scenes*

On a visit to IFIC at the University of Valencia on February 8-11, Barnett and Pequenao met with the four animators (shown in Figure 3) to further refine every scene and the timing. Animation of the ATLAS and CERN entrance (Gate B) area is already realistic. A large render farm at Michigan State University will meet the substantial needs. This is of major importance, because rendering will take months of computer time.

Recently, Pequenao and the four animators traveled to the *ThinkTank Science Museum* in Birmingham (UK) to view preliminary draft segments in a real planetarium as well as a wide array of planetarium shows in a private setting with the planetarium director.

Current estimates for final completion is early 2014. The team is confident that the planetarium show will be widely appreciated.

### 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](http://www.sanfordlab.org)**

Like SURF on Facebook:  
<http://www.facebook.com/SURFAtHomestake>



## SURF IN THE NEWS

*LA Times:* [Deep in a former gold mine, scientists hunt for dark matter](#) (Amina Khan, April 8)

*Berkeley Lab:* [Hunting for Matter that's Rarer than Gold](#) (April 10)

*The Daily Republic* (Denise Ross): [Ray Davis heralded as a neutrino pioneer](#) (April 6)

[A taxpayer's guide to the galaxy](#) (April 6)

*SDPB:* [LUX Dark Matter Experiment](#) (Nathan Puhl, April 5)

*Aberdeen News:* [Dark matter being explored in SD](#) (Jeff Natalie-lees, April 9)

*Black Hills Pioneer* (Wendy Pitlick): [International physics creating positive move](#) (April 11)

[World's purest copper being formed in Lead](#) (April 5)

[DOE begins lab environmental assessment](#) (March 30)

[Lab won't be affected by sequestration](#) (March 26)

**Articles from [www.symmetrymagazine.org/](http://www.symmetrymagazine.org/):**  
*CERN offers UN advice on bringing women into science* (April 5)

*Meet 63 women in STEM, and counting* (March 20)

## DURA News

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

## SANFORD UNDERGROUND LABORATORY NEWS

### Richard Hammond visits Sanford Lab

Richard Hammond, English broadcaster and journalist, most noted for co-hosting the BBC car programme *Top Gear*, visited SURF on March 26 with a BBC documentary crew to tape segments for a two-part science documentary, *How to Build a Planet*. Hammond spent four hours underground discussing dark matter with Brown University

professor and LUX physicist Rick Gaitskell (shown in Figure 4). The Sanford Lab segments focus on the strength of gravity and on the LUX dark-matter detector.



*Figure 4: Richard Hammond holds prop plasma ball and questions Rick Gaitskell about the LUX experiment*



*Figure 5: Garden gnome created by Kern Precision Scales*

With Hammond was a ceramic garden gnome (see Figure 5) created by *Kern Precision Scales*. The gnome has traveled the world with a Kern scale, demonstrating how the force of gravity differs at various locations. Previous stops include the South Pole and SNOLAB in Canada. The documentary should be complete for airing by this summer.



*Figure 6: Members of the MAJORANA DEMONSTRATOR collaboration in front of Yates Shaft headframe with PIs John Wilkerson and Steve Elliott*

### MAJORANA DEMONSTRATOR (MJD) Meeting

During the first week of April, over 40 **MAJORANA DEMONSTRATOR** researchers (shown in Figure 6) met at Sanford Lab to assess progress and schedules

for the experiment. The collaboration, led by PIs John Wilkerson of University of North Carolina, and Steve Elliott of Los Alamos National Lab, includes scientists from 18 different institutions.

**Ross Shaft Construction Updates**

Steve Babbitt (shown below), a photography professor at Black Hills State University who received a Distinguished Faculty Award from Black Hills State University on March 4, has been working with the SURF Communications Department for the past three years to document the creation of the Sanford Lab. In recent months, he has spent time photographing the Ross Shaft (see Figures 7 and 8). A fine-arts and industrial photographer, he is used to working in challenging environments.



*Photographer Steve Babbitt*



*Figure 7: Looking down the Ross Shaft with photographer Steve Babbitt standing on a work deck in the cage compartment*



*Figure 8: A bearing beam in concrete, with new rock bolts and ground support. Pump column at right*

Babbitt felt that the assignment was similar to shooting in caves or in the slot canyons of Southern Utah. “It’s rare that I have to work in such a confined space,” he said. “To be able to look up and down the shaft, that was pretty impressive.”

**Ross Shaft Steel replacement**, a long-term project, which will eventually cover the entire 5000-foot shaft, has now reached below the 300 Level. The shaft was originally constructed with steel I-beams in 6-foot sections. Crews (such as one shown in Figure 9) are removing the old steel as they work their way down the shaft, and replacing it with new tubular steel based on 18-foot vertical sets. Horizontal tubular steel dividers will separate the compartments that run the length of the shaft.



*Figure 9: Infrastructure Techs Jerry Hinker, Loren Larsen, Derek Lucero, and Joe Nonnast at the 300 Level, with the vertical steel (gray) in place. Red structures are work decks*

**EDUCATION AND OUTREACH**

**Recent Activities**

**K-12 Students and Teachers**

In March, school groups began to visit Sanford Lab. Thirty members of the Belle Fourche Eighth Grade Science and Math Club spent the morning of March 1 doing a radiation workshop and Hoist Room tour with SURF Education and Outreach Deputy Director Peggy Norris and Science Education Specialist Julie Dahl. On March 9, SURF Education and Outreach Director Ben Sayler hosted five students and 11 adults from Pennington County 4H for an activity and Hoist Room tour.

On March 21, Chamberlain High School and McIntosh High School (shown in Figure 10) brought their physics and chemistry students for a day of workshops. In the morning, they learned about dark matter and had a videoconference with the Science

Department's Mark Hanhardt at the LUX experiment at the Davis campus. They also took part in a water filtering design activity. After lunch, they received a tour of the Waste Water Treatment Plant and Hoist Room. Thanks to Jim Whitlock and Duane Ennis for the great tour of the treatment plant, and to Matt Kapust for setting up the videoconference.



*Figure 10: Jennifer Bennett (left), Megan Plush, Lexus Kelsch, and Shaunee Hansen, juniors at McIntosh High School, test their water-treatment filter*

The Quarknet Center at BHSU, led by Kara Keeter, participated in Quarknet Master Classes again this year, trying their hand at analyzing data from the ATLAS experiment at the Large Hadron Collider. Approximately 30 students attended with their teachers from seven high schools in South Dakota and Wyoming.



*Figure 11: Ben Saylor and James Verbus participate in a panel discussion at the Spearfish High School Career Fair*

Ben Saylor and James Verbus (Brown University graduate student working on LUX) represented the Laboratory on a panel at a Career Fair for Spearfish High School on March 26 (see Figure 11). Approximately 50 students participated.

**Undergraduates**

Nine students have been chosen for the Davis-Bahcall Scholars program for 2013, which will run from July 7 through August 4. The students are:

Student	School	Hometown
Zachery Crandall	Britton-Hecla High School	Lidgerwood, ND
Adrian Del Grosso	Huron High School	Huron
Rashyll Leonard	SDSMT	Montrose, CO
Ka Yan Lee	Aberdeen Central High School	Aberdeen
Lia Meirose	Sturgis High School	Sturgis
Rachel Nevin	Lincoln High School	Sioux Falls
Daniel Ostraat	Canton High School	Canton
Eric Roach	USD	Sioux Falls
Dakotah Simpson	Lead-Deadwood High School	Lead

After two weeks of study at Sanford Lab, students will travel to Gran Sasso Laboratory and other labs in Italy as well as Fermilab and Argonne National Lab. They will be chaperoned by Rose Emanuel, physics teacher from Lead-Deadwood High School. The program is supported by 3M Corporation and the South Dakota Space Grant Consortium.

**ENVIRONMENT, HEALTH & SAFETY**



**Some Key Safety Tips**

- Have the right safety attitude
- Practice safe work habits
- Come to work refreshed and ready to do your job
- Think before you act
- Keep your mind on your work

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

## STAFF NEWS



**Sharon Hemmington** is the new Business Services and Contracts Manager at Sanford Lab. She earned her bachelor's and master's degrees at Black Hills State University. She also worked at BHSU for over 26 years, directing a federal TRI0 program for eleven years and serving as the Director of Sponsored Programs (pre- and post-award grants and contracts) for the last ten. The opportunity to join the SDSTA staff was too appealing, and Sharon is very excited to be able to help support the incredible research happening at the Sanford Lab.

Sharon and her husband Todd have two grown kids: Tyler works for the University of South Dakota in Sioux Falls, and Kaitlyn is pursuing a graduate degree at South Dakota State University. Sharon and Todd like to spend spend their weekends hiking and appreciating all the Black Hills has to offer.

## UPCOMING CONFERENCES AND WORKSHOPS

**Intensity Frontier Workshop**, Argonne National Lab, April 25-27, 2013. The Intensity Frontier working group will be holding an all-hands workshop as part of the ongoing 2013 Community Summer Study ("Snowmass").

<https://indico.fnal.gov/conferenceDisplay.py?confId=6248>

**INPAC/MRPI General Meeting - New Directions in Nuclear/Particle Astrophysics and Cosmology**, Asilomar Conference Grounds, Pacific Grove, CA, April 26-28, 2013. <http://cosmology.berkeley.edu/inpac-mrpi/Main/INPAC-MRPI>

**International Symposium: Opportunities in Underground Physics for Snowmass (ISOUPS13)**, Asilomar Conference Grounds, Pacific Grove, CA, May 24-27, 2013.

<http://neutrino.physics.ucdavis.edu/indico/conferenceDisplay.py?ovw=True&confId=0>

**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, 47<sup>th</sup> US Rock Mechanics/Geomechanics Symposium**, Westin San Francisco Market Street, San Francisco, CA. June 23-26, 2013.

<http://armasyposium.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

**Two Postdoc Fellowships, CSNSM Orsay; CEA Saclay, France.** Research related to search for rare events with bolometric detectors. Orsay: Deadline 4/30/13. [andrea.giuliani@csnsm.in2p3.fr](mailto:andrea.giuliani@csnsm.in2p3.fr); Saclay: [martin.loidl@cea.fr](mailto:martin.loidl@cea.fr).

**CEA (Saclay):** Experimental physics, LUMINEU project. Martin Loidl, [martin.loidl@cea.fr](mailto: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](mailto:proebst@mpp.mpg.de). Apply: Sybille Rodriguez, MPI, Föhringer Ring 6, D-80805, München. [rodi@mpp.mpg.de](mailto:rodi@mpp.mpg.de).

**PhD Graduate Research Assistant in Deep Life Study, DRI Las Vegas and UNLV School of Life Sciences, Nevada.** Deep drilling programs associated with Death Valley National Park, Nevada National Security site, and other underground locations. Interdisciplinary team includes USC, Caltech, Rensselaer, and JPL. Duane Moser, Desert Research Institute, 755 E. Flamingo Rd., Las Vegas, NV 819119. [Duane.moser@dri.edu](mailto:Duane.moser@dri.edu).

**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](mailto:LUXLZ_postdoc@phys.cwru.edu).

**Tenure track position, Chancellor's Fellowship, University of Edinburgh.** Teaching and research in nuclear/particle physics. Research in ATLAS or LHCb. Deadline: 4/18/13. Dr. Alex Murphy, [a.s.murphy@ed.ac.uk](mailto:a.s.murphy@ed.ac.uk)  
<http://www.ph.ed.ac.uk/chancellors-fellows>

**Postdoctoral Researchers, Dept. of Physics, Eng. Physics & Astronomy, Queen's University.** Experimental Neutrino Physics, in Particle Astrophysics group, work on SNO+ experiment. Alex Wright, IP Research Scientist & Asst. Professor, Dept. of Physics, Queen's University, Kingston, ON K7L 3N6, Canada. [awright@physics.queensu.ca](mailto:awright@physics.queensu.ca)

**Postdoctoral Researcher, LLNL, Livermore.** Research in Experimental Nuclear Physics (ENP) Group/Nuclear and High Energy Physics. Support of CUORE. Nicholas Scielzo ([scielzo1@llnl.gov](mailto:scielzo1@llnl.gov))  
[https://careers-prd.llnl.gov/psp/careers/EMPLOYEE/HRMS/c/HRS\\_HRA\\_M.HRS\\_CE.GBL?Page=HRS\\_CE\\_JOB\\_DTL&Action=A&JobOpeningId=11017&SiteId=1&PostingSeq=1](https://careers-prd.llnl.gov/psp/careers/EMPLOYEE/HRMS/c/HRS_HRA_M.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](mailto:ilevine@iusb.edu). Dept. of Physics & Astronomy, IUSB, 1700 Mishawaka Ave., South Bend, IN, 46634. Deadline: 3/1/13.

<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. Review begins 2/1/13. <https://yourfuture.sdbor.edu>

**Tenure track faculty positions in Physics at South Dakota School of Mines.** New SURF-related research program in particle physics, 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. <http://www.sdsmt.edu/employment>

**Newsletter Editor:** Melissa Barclay

**Contributors:** Kevin Lesko; Bill Harlan (Sanford Lab local news); Christina Keller (New Physics Ph.D. Program in South Dakota); Michael Barnett (Planetarium Show on Dark Matter); Jaime Hopmeier (Safety); Peggy Norris, Ben Saylor (Education and Outreach)

**Photo Credits:** Fig. 1: South Dakota Governor Dugaard's Office; Fig. 2: USD grad students; Fig. 3: Michael Barnett; Figs. 4,10: Bill Harlan; Figs. 5,6,9: Matt Kapust; Figs. 7,8: Steve Babbitt, BHSU; Fig. 11: Bryan Walker (Spearfish Economic Development)

**Lawrence Berkeley National Lab**

Kevin T. Lesko: 510-486-7731  
[KTLesko@lbl.gov](mailto:KTLesko@lbl.gov)  
Melissa Barclay: 510-486-5237  
[mbarclay@berkeley.edu](mailto:mbarclay@berkeley.edu)

**SDSTA/Sanford Lab**

Ron Wheeler, Executive Director  
Mandy Knight, 605-722-8650, x222  
[MKnight@sanfordlab.org](mailto:MKnight@sanfordlab.org)  
<http://www.sanfordlab.org/>

**BERKELEY OFFICE  
New address**

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