

**Dear SURF Readers,**

Welcome to the June 2014 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](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

**June 30: Visitor Center Groundbreaking, 10 am – Lead, South Dakota - Visitor Center Parking Lot**

**July 12: Neutrino Day - Lead, South Dakota**

## The Inauguration of the Berkeley Low Background Facility at SURF

After three decades of successful operation at its longtime underground home under the Oroville Dam in Northern California, the Low Background Facility (LBF) of the Lawrence Berkeley National Laboratory (LBNL) has relocated its “offsite” detector to a much deeper site at the Sanford Underground Research Facility in South Dakota.

The counting station, with the original HPGe detector and shield structure, was reinstalled in the LUX East Counting Room area at the 4850 Level Davis Campus in May; it is now known as the Berkeley Low Background Facility (BLBF) at SURF. LBF’s other detectors continue to operate in Building 72 at LBNL. Over the years, LBF has provided critical assay services to many underground physics collaborations including SNO, KamLAND, LUX, Daya Bay, CUORE, DUSEL, and LBNE and more recently to LZ, MAJORANA DEMONSTRATOR, DM-ICE, and SURF.

An official ceremony to mark the transition took place on April 21 with LBNL and Oroville personnel (see Figure 1). Kevin Lesko, SURF Head of Operations and LBNL Senior Scientist, led the presentations. James Symons, Associate Laboratory Director for Physical Sciences, presented a

memento made from a germanium crystal from the first UC Santa Barbara-LBNL experiment at Oroville. Yuen-Dat Chan, LBNL scientist, presented an LBNL retirement plaque to Donna Hurley, and Alan Smith addressed the audience with a history of the connection between LBNL and the Oroville Dam.



*Figure 1: Left to right: Keenan Thomas, James Symons, Steve Dardin, Donna Hurley, Kevin Lesko, Alan Smith, and Yuen-Dat Chan at the Oroville site*

After a four-month period of construction and commissioning, led by Keenan Thomas (shown in Figure 2) from UC Berkeley, BLBF is now fully functional at Sanford Lab. A 14-day background run of the detector indicates that the measured background is lower than that achieved at Oroville. BLBF at SURF will be overseen by staff from the Low Background Facility at LBNL, assisted by members of the SURF Science Department. In particular, SURF science interns, Colter Dunagan and Rashyll Leonard provided much appreciated support in re-establishing the detector underground in the Davis Campus. More on their experiences can be found on page 6.



*Figure 2: Keenan Thomas completes final commissioning steps of the Berkeley Low Background Facility located at SURF's 4850 Level*



*Figure 3: Illustration of Berkeley Lab Low Background Counting Facility at the Sanford Lab Davis Campus. Currently, only one detector is being installed but the space can accommodate a second detector*

The BLBF detector will be operated remotely out of the 4850 Level (4300 mwe) Davis Campus. Standard operations of the LBF include pre-screening of samples on the surface at Berkeley followed by underground screening with the remote counter.

With the move from Oroville, sufficient low activity shield materials provided by UC Santa Barbara in the original UCSB-LBL double beta decay and dark matter search experiments were shipped to SURF to provide comparable shielding for one or two additional HPGe detectors. The East Counting Room is set up to receive at least one more detector. Plans for the future include relocating the detectors to the Black Hills State University facility near the Ross Shaft at the 4850 Level when it is ready. The BHSU facility will be able to support 6 to 8 assay stations.

**LBF anticipates re-initiating service to the low background science community for material radioactivity screening on July 1.**

Researchers interested in submitting samples for assay should contact: A.R. Smith ([arsmith@lbl.gov](mailto:arsmith@lbl.gov)), Keenan Thomas ([kjthomas@lbl.gov](mailto:kjthomas@lbl.gov)), Alan Poon ([awpoon@lbl.gov](mailto:awpoon@lbl.gov)) or Kevin Lesko ([ktlesko@lbl.gov](mailto:ktlesko@lbl.gov)). More information about LBF/BLBF can be found at: <https://sites.google.com/a/lbl.gov/low-background-facility/>.

### **Natalie Roe Testifies on Particle Physics**

Natalie Roe, Berkeley Lab's Physics Division Director, testified before Congress on the future of particle physics on June 10. Her testimony focused on the Particle Physics Project Prioritization Panel or P5 recommendation (featured in the May 2014 SURF newsletter).

Among various experiments and topics of scientific import, Roe mentioned SURF. "P5's recommendation supports another class of small to medium scale experiments to address dark matter that will advance the frontiers of our knowledge of the dark universe," Natalie Roe said. "A deep underground site to carry out this type of dark matter search already exists in the US in South Dakota. It is called the Sanford Underground Research Facility (SURF)."

Roe also spoke on these issues at the Large Hadron Collider Physics Conference in New York on June 6. To read more about these events or Natalie Roe's comments, please reference the articles in *Symmetry* (June 12) and *Today at Berkeley Lab* (June 20) listed below.

### **Reports/Papers Available**

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

[Scientific Opportunities with the Long-Baseline Neutrino Experiment](#) (Cornell University Library, <http://arxiv.org/abs/1307.7335>)

**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**

*Huffington Post:* [Particle Physics for the Future in the U.S.](#) (Alice Bean, May 31)

*Washington Times:* [Lead visitor center on track for June construction](#) (Tom Griffith, May 25)

*Symmetry:* [Researchers imagine the accelerators of the future](#) (Sarah Charley, June 12)

*Today at Berkeley Lab:* [Natalie Roe Testifies Before Congress on Particle Physics' Future](#) (Kate Greene, June 20)

*Gizmodo*: [U.S. Physics Panel Wants to Build Billion-Dollar, 800-Mile Neutrino Beam](#) (Jamie Condliffe, May 23)

*Live Science*: [Report: New Physics Should Hunt Dark Matter & Energy](#) (Tia Ghose, May 23)

*SDPB*: [Sanford Lab Fits Particle Physicists 10-Year Plan](#) (Charles Michael Ray, June 2)

*South Dakota School of Mines & Technology*: [Student awarded \\$10K to update Homestake-era ventilation at Sanford Lab](#) (June 4)

*Rapid City Journal*: [Noem tours Sanford Underground Laboratory at Homestake](#) (June 11)

*Black Hills Pioneer*: [BHSU President receives honorary doctorate](#) (June 13)

[Noem visits Lab's 4850 level](#) (Adam Hurlburt, June 12)

[Marketing students use classroom to impact community](#) (May 31)

[Underground Lab used as inspiration for compositions](#) (May 31)

### 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

#### LUX Update

LUX collaborators have been preparing, since October 2013, for a 300-day run which will be four times longer than the initial run. They are taking steps to improve the detector's sensitivity (see Figure 4). "We upgraded peripheral systems and did voltage conditioning," said Simon Fiorucci, LUX postdoctoral researcher from Brown University and LUX Science Run Coordinator.

In addition, "measures were taken to ensure that improvements and lessons learned from the initial operation period were put in place for the upcoming extended detector operation period, including a review by an independent safety committee," said

Jaret Heise, SURF Director of Science. A review of all critical detector operation procedures was also conducted by the collaboration, primarily led by Chuck Lichtenwalner, SURF Experiment Health and Safety Manager.



*Figure 4: View beneath the LUX dark matter detector during its construction. LUX uses photo multiplier tubes to detect faint interactions in liquid xenon.*

"This is a first step toward a new run that will allow us to substantially improve the sensitivity of LUX," said LUX co-spokesperson Rick Gaitskell of Brown University.

After the reviews, Sanford Lab granted approval to begin condensing the xenon gas. With the liquid xenon in place, LUX researchers will begin a series of tests and calibrations to determine the detector's response to gamma rays and neutrons. They are also looking for low-energy responses to decay products of krypton and tritium that are injected into the detector's gas flow—a process developed by the LUX collaboration.

After the run is complete, LUX collaborators will analyze the data to determine findings. Light detectors in the top and bottom of the detector can detect a single photon so that interactions can be pinpointed to within a few milliliters.

"Neutrons and gamma rays scatter multiple times when they interact with the liquid xenon," said LUX co-spokesperson Dan McKinsey of Yale. "Dark matter will only scatter once. That's what we'll be looking for."



#### Info on Travel through Lead

The City of Lead will be working on roads from May 1 to October 1, 2014 and into 2015, with the starting

and ending dates subject to weather conditions. The City of Deadwood project is expected to overlap during 2015 and will cause problems with access to SURF from Deadwood up Hwy 85 to Mill Street. It is recommended that all SURF traffic come through Central City, via Hwy 14.

In 2014, the Main Street utilities and grading project will move in 3-block intervals starting at the east end of Julius and Main Street and progress towards Blue Street. Main Street traffic will be detoured to Julius Street.

In 2015, the project will continue from Blue Street to Blatt Street. In 2014, beyond the main construction effort, there will be intermittent road closures due to joint and spall repair activities ongoing from Pluma to the top of Glover's Hill and Baltimore, where they join with Hwy 14.

Main Street will be completely closed and there is a tight radius turn from Main Street onto any street to connect to the detour street of Julius Street. Delivery trucks carrying long or wide loads should travel via West Summit Street.

### EDUCATION AND OUTREACH

#### Davis-Bahcall Scholars

Ten eager students arrived at Sanford Lab on June 9 for the first week of the 2014 Davis-Bahcall program (see Figure 5). In its sixth year, with generous funding from *3M Corporation*, the *South Dakota Space Grant Consortium*, and *South Dakota NSF EPSCoR*, the Davis-Bahcall program is unique. Students entering their freshman or sophomore year of college as STEM majors are recruited from across the state, and given a taste of what modern science and engineering research is all about during the four to five weeks they spend at Sanford Lab, in addition to the travel portion of the program. This year's class is unique as well, with 60% females and 60% physics majors.

After a day of safety training, the students began their in-depth study of modern physics with guest lecturer Dr. Drew Alton, from Augustana College, and Dr. Peggy Norris, from BHSU/Sanford Lab. The first week was primarily devoted to the basics of particle, nuclear, and astrophysics. In addition, they toured the BHSU Spectroscopy Laboratory with Dr. Brianna Mount, and the Sanford Lab Surface

Laboratory, with a talk by USD graduate student Angela Chiller. They heard from a panel of six staff from the Engineering Department, who gave insight into engineering career paths based on their own varied experiences. They learned about dark matter and the LUX experiment from Mark Hanhardt, SDSMT graduate student and Sanford Lab Science Department staff member.



*Figure 5: Tod Olsen (3M), Noah Watkins, Pranammya Dey, Madison Jilek, Allison Van Horn, Jack Storm, Hannah Wisser, Rachel Williams, Kassia Symstad, Layne Droppers, Mattison Flakus at Davis-Bahcall 3M presentation on June 20*

During the second week, students learned about cosmic ray muon detectors and neutrinoless double beta decay, and prepared for their trip underground on June 19. Other activities included tours of the Waste Water Treatment Plant and Black Hills Mining Museum. On June 20, their last day at Sanford Lab, they were visited by South Dakota Governor Dennis Daugaard.

Students then left for an extensive road trip to Chicago. Stops include the Soudan Science Laboratory, the NOvA experiment in International Falls, Minnesota, University of Wisconsin, Fermilab, and Argonne National Laboratory. They will then board a plane to Rome, where they will spend three days at the Gran Sasso Laboratory for lectures and a tour, and a day at the Frascati Accelerator Laboratory. On their return to Rapid City, they will help with Neutrino Day.

Six of the ten students are also participating in pre-/post-program internships, with stipends from the *South Dakota Office of Economic Development* and *South Dakota EPSCoR*:

- BHSU student Rachel Williams is interning with the USD CUBED project
- SDSMT student Hannah Wisser is interning with the SDSMT Physics Department
- Jack Storm, who will also be attending SDSMT, is interning with a nanotechnology group on campus

- Noah Watkins, who will be attending Augustana College, is interning with their physics department
- Allison Van Horn, who will be attending SDSU, is interning with *Vantage Point Engineering* in Mitchell

On Monday, July 14, students will be giving final presentations on their experience with the Davis-Bahcall program. The presentations are tentatively scheduled to start at 10:00 in the Yates Conference Room at Sanford Lab, and all are invited. Please watch the Sanford Lab Facebook page for blogs that the students will post from their various stops on their journey.

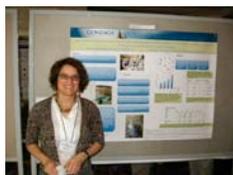
### ENVIRONMENT, HEALTH & SAFETY



#### Fourth of July Safety

- Do not use illegal fireworks – attend your town's local fireworks display
- Keep picnic foods covered and chilled; keep children away from campfires and grills
- Apply sunscreen with a minimum 15 SPF
- Drink plenty of fluids
- Keep your pets inside

### STAFF NEWS



**Bree Reynolds** is the new STEM (Science, Technology, Engineering, and Math) Education Specialist for the Sanford Underground Research Facility. She recently moved to South Dakota from the island nation of Dominica where she was the Curriculum Director for Ross University School of Medicine. Bree is a graduate student at the University of Idaho, working on her PhD in curriculum and instruction in science education. Her dissertation research examines the phenomenology of culturally sustaining pedagogy in the science classroom. She has over seven years of teaching experience, including high school science on the Spokane Indian Reservation in Washington State and middle school science in the Northern Mariana Islands. Bree was also actively involved in research as a science educator, receiving the *Murdock Partners in Science* grant that allowed her

to investigate the impacts of uranium mining on a watershed. She also assisted Dr. Jennifer Shepherd from Gonzaga University researching new drug therapies for intestinal parasites through inhibition of anaerobic respiration.

Bree is married and has two daughters: one is following in her footsteps by majoring in education and biology at University of Montana Western. The other is six years old.



*Figure 6: Sanford Lab Trainer Roger Hudson (kneeling) safety-trained a class of 17 researchers, summer interns, Davis-Bahcall Scholars, and one new employee*

### Meet the Summer Interns

In June, Sanford Lab welcomed six summer interns. They will be assisting in all aspects of life at Sanford Lab.

Recipients of the Chris Bauer Engineering Internships include Wade Vandine and Dakotah Simpson.



**Wade Vandine**, a freshman who will be studying mechanical engineering at South Dakota School of Mines & Technology (SDSMT), will be working with Project Engineer Bryce Pietzyk. Some of his work will be in ground support with HAZMAT crews, rock bolting, drawing, design and CAD drafting. Vandine is following in a long line of Homestake workers that traces back to his great-grandfather. Vandine's father George is the Foreman of the Ross Shaft. "I'm honored to be able to work with my father in a place that's been a part of our family for so many years," Wade said.

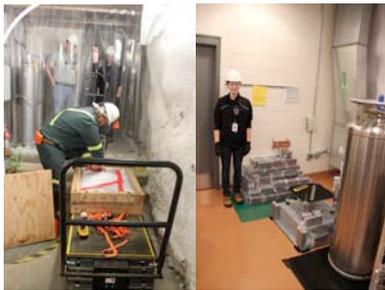


**Dakotah Simpson**, also of SDSMT, will be working in Operations with Surface Operations Foreman Dan Regan and others on the team. A former Davis-Bahcall Scholar, Simpson will be a sophomore in the fall, studying electrical engineering. Simpson has plenty of work lined up, including building support for the Oro Hondo fan, reorganizing the surface lab and core samples, and helping install new carbon dioxide sensors.

Dave Bozied interns, all studying at SDSMT, include Colter Dunagan and Rashyll Leonard working in Science, and David Molash in industrial Hygiene.



*Colter Dunagan and Rashyll Leonard at the 4850 Level*



*Figure 7: (Left) Colter Dunagan moving lead bricks into the clean space; (Right) Rashyll Leonard standing next to the lead bricks*

**Colter Dunagan** shares his experience as an intern:

One of the first things I was asked to do when I started working underground was to assist Keenan Thomas with the construction of the Low Background Facility detector at Sanford Lab. First, we prepped the area where the detector was to be placed. However, most of the work consisted of moving lead bricks from the drift into the count room (shown in Figure 7), and then stacking the shield to

mitigate external radiation. I was stationed outside the Davis Campus in the drift, and my task was to take the lead bricks out of their storage crates and place them in a cart so they could be wheeled inside to the count room. Once inside, the lead bricks were stacked by Keenan. Once a certain layer was reached, we placed the first layer of copper shielding, positioned the detector, and then placed the rest of the lead bricks and copper shielding. We then wrapped the entire stack of lead bricks in aluminized Mylar to help with further shielding.

I have also worked with the MAJORANA DEMONSTRATOR team learning the various processes that the collaboration employs. I have learned how to use the Parts Tracking database, how to laser engrave parts to be used in the detector, and how to quality control check parts made in the machine shop. I have had the chance to go over to the Temporary Clean Room (TCR) and learn how to do bath maintenance, as well as cleaning copper nuggets to add to the baths. Every morning, I help clean the boot wash area. I have helped clean the machine shop and the detector room. Over the first half of my internship, there has not been a day that I have not learned some useful skill or something new about lab operations. It has been a truly amazing experience.



*Rashyll Leonard working in the glovebox*

**Rashyll Leonard** shares her experience:

I am a third year physics undergraduate at the School of Mines in Rapid City, and am so glad to be here at SURF this summer! Part of the reason I chose the School of Mines was its proximity to Sanford Lab and the chance to work in it, so having this opportunity is pretty incredible!

So far this summer, I have worked with Keenan Thomas setting up the BLBF, and also with the MAJORANA DEMONSTRATOR project. For Keenan, Colter and I helped stack lead bricks, assemble the

detector, and set up the LN autofill system. For MAJORANA, we have done a variety of things, including going to the Temporary Clean Room, working in the machine shop, and even helping assemble a string in the glovebox! (See photo above.) We have also done a lot of jobs just to help out around Sanford Lab. Troubleshooting the phone system and helping Robyn clean are just some of the recurring tasks. I am really enjoying my time here. I look forward to learning more from all the scientists, and having even more chances to work in all aspects of the experiments at the 4850 Level.



**David Molash** is a physics student from SDSM&T participating in a 10-week internship. His program began on June 9; on June 11, he went underground to begin familiarizing himself with the experiments and their environment. Molash will be working with SURF Experiment Health and Safety Manager Chuck Lichtenwalner to capture process and display a large variety of data pertaining to the underground experiments. The two will gather data on seismic events, airflows, temperature on the surface, and particle counts, among other things, which will be necessary in documenting what Lichtenwalner refers to as "underground weather".



**Stephen Farghali** is a senior at Black Hills State University, double-majoring in mass communications and psychology. As Communications Intern, Farghali will write articles, participate in multimedia projects, assist with Neutrino Day, and play a key role in updating the website.

"We want Stephen to fully experience what it is like to work in a communications department," said SURF Communications Director Constance Walter. "It will give him a competitive edge when he graduates from college and enters the work force."



**Billie White** is a Human Services and Sociology major from Black Hills State University. White is doing an internship in Sanford Lab's IT department through the end of August. Her responsibilities include troubleshooting problems that arise with staff computers in order to keep everyone up and running. She will be working with SURF's IT Senior Systems Admin Deb Meyer and Content Management Applications Developer Dave Turner.

### UPCOMING CONFERENCES AND WORKSHOPS

**Neutrino Day, Lead, South Dakota.** July 12, 2014. Annual free science festival at SURF, Homestake Visitor Center, and downtown Lead. Science exhibits and talks, surface campus tours of SURF, and other activities. <http://sanfordlab.org/>

**42<sup>nd</sup> SLAC Summer Institute 2014, SLAC, Menlo Park, CA.** Shining Light on Dark Matter, August 4-15, 2014. Focus on quest to identify Dark Matter. Morning lectures, afternoon topical conference talks, discussion sessions, tours, and social events. <http://www-conf.slac.stanford.edu/ssi/2014/>

**Neutrino Summer School, St. Andrews, Scotland,** August 10-22, 2014. An opportunity for students and postdocs to discuss neutrino physics. <http://www.hep.anl.gov/ndk/hypertext/numeetings.html#ins14>

**The 2<sup>nd</sup> Workshop on Germanium-Based Detectors and Technologies,** University of South Dakota, September 14-17, 2014. To register, submit abstracts, apply for fellowships or more details, visit: <http://www.geworkshop.org/indic>

**Perspectives of GPU Computing in Physics and Astrophysics, Rome, Italy,** September 15-17, 2014. Companion workshop on GPU High Energy Physics, September 10-12 in Pisa. <http://www.roma1.infn.it/conference/GPU2014/>

**Present and Future Neutrino Physics, KITP, UC Santa Barbara,** September 29-December 29, 2014. Topics include neutrino oscillations, nature of neutrino mass, absolute neutrino mass scale, and neutrino physics beyond the Standard Model.

<http://www.kitp.ucsb.edu/activities/dbdetails?acro=neutrinos14>

**Low Radioactivity Techniques, Workshop V, University of Washington, Seattle**, March 18-20, 2015. Topics include dark matter, solar neutrinos, double-beta decay, and long half-life phenomena. <https://www.npl.washington.edu/indico/conferenceDisplay.py?ovw=True&confid=5>



**JOBS**

**Postdoctoral researcher positions (2), UC Berkeley.** Work on neutrinoless double beta decay with CUORE and SNO+. Gabriel Orebi Gann [gabrielog@berkeley.edu](mailto:gabrielog@berkeley.edu), Yury Kolomensky, [yury@physics.berkeley.edu](mailto:yury@physics.berkeley.edu)

**Research Associate, Stanford-SLAC.** One or more openings. Participate in LUX science running, launching LZ, and long-term R&D. Dan Akerib, [akerib@slac.stanford.edu](mailto:akerib@slac.stanford.edu). Deadline: 6/1/14. <https://academicjobsonline.org/ajo/jobs/4012>

**Postdoctoral Research Associate, Wright Laboratory, Yale University.** Two openings in Weak Interactions Group. Contact: Profs. Reina Maruyama, [reina.maruyama@yale.edu](mailto:reina.maruyama@yale.edu) or Karsten Heeger, [karsten.heeger@yale.edu](mailto:karsten.heeger@yale.edu) <http://wlab.yale.edu/opportunities>

**Postdoctoral fellowship, University of Alberta.** Research in IceCube and PINGU. Review begins 7/2/14. Darren Grant, [drg@ualberta.ca](mailto:drg@ualberta.ca) <http://www.postdoc.ualberta.ca/en/Postdoc%20Opportunities.aspx>

**Two Faculty positions, Carleton University, Ottawa, Canada.** Research in particle physics, especially EXO. Review begins: 8/1/14. Info: Gerald Oakham, [physchair@physics.carleton.ca](mailto:physchair@physics.carleton.ca) or Joanne Martin, [jmartin@physics.carleton.ca](mailto:jmartin@physics.carleton.ca) <http://physics.carleton.ca/news/14/assistant-professor-particle-physics-2015> <http://physics.carleton.ca/news/14/crc-tier-i-tenured-professor-particle-physics-2015>

**Postdoctoral positions in elementary particle physics, Michigan State University.** Research in long baseline neutrino oscillation projects. Contact: [kendall.mahn@gmail.com](mailto:kendall.mahn@gmail.com)

<https://inspirehep.net/record/1298448>

**Postdoctoral Research Associate, University of Minnesota.** Work on NOvA and MINOS+ experiments. Contact: Gregory Pawloski, [pawloski@umn.edu](mailto:pawloski@umn.edu) <http://inspirehep.net/record/1292955?ln=en>

**Tenure-track faculty position, South Dakota School of Mines, Rapid City, SD.** Assistant, Associate or Professor of Physics position (based upon qualifications) in South Dakota's new physics doctoral program. Open until filled. <http://inspirehep.net/record/1260920> <http://inspirehep.net/record/1260921>

**Postdoctoral position, University of North Carolina, Chapel Hill.** Research in Experimental Nuclear and Particle Astrophysics. Work with MAJORANA and KATRIN. John Wilkerson. [jfw@physics.unc.edu](mailto:jfw@physics.unc.edu) <https://unc.peopleadmin.com/postings/31072>

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**Contributors:** Kevin Lesko; Connie Walter (Sanford Lab news); Yuen-Dat Chan, Kevin Lesko, Keenan Thomas (The Inauguration of BLBF (Berkeley Low Background Facility) at SURF); Peggy Norris, Ben Saylor (Education and Outreach)

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