

**Dear SURF Readers,**

Welcome to the August 2013 Sanford Underground Research Facility (SURF) monthly newsletter. The newsletter is also posted online, and a pdf copy is available. You can read recent and archived newsletters at our website at [www.sanfordlab.org](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

**August 25-30: LUX Analysis Workshop – Lead, SD**

**Sept. 9-13: TAUP 2013 – Asilomar, CA**

**October 11-13: MJD Collaboration Meeting – Lead, SD**

## New PhD physics program

August 20 marked the first day of the new doctoral physics program in South Dakota. The inaugural twelve students met at Sanford Lab for an all-day orientation with faculty from three South Dakota universities (shown in Figure 1). Six students will study at the South Dakota School of Mines and Technology (SDSMT) in Rapid City, and six will study at the University of South Dakota (USD) on the eastern side of the state. The doctoral candidates will focus on Sanford Lab research.



*Figure 1: Front row left, USD Physics Department Director Tina Keller; on the right, SDSMT Physics Department Head Andre Petukhov. Middle: twelve students with supporting faculty and staff*

In preparation for the new program, South Dakota hired four new physics faculty as Assistant Professors: Joel Sander and Ryan Martin at USD, and Alberto Lemut and Luke Corwin at SDSMT. SDSMT will add two additional particle physicists next year in a structured growth of the new doctoral program, which, thanks in part to its close ties with Sanford Lab, is poised to become a leader in particle physics research.

“The Sanford Underground Research Facility holds a promise to become one of the biggest underground particle physics laboratories in the world,” said Andre Petukhov, Head of SDSMT’s Department of Physics. “This world-class facility will create unmatched opportunity for our students, and we envision many start-up companies around this lab.”

Alberto Lemut’s research activities have primarily focused on experimental nuclear astrophysics. He has conducted and participated in several deep underground cross section measurements at the Laboratory for Underground Nuclear Astrophysics (LUNA) facility. Most recently, he held the position of co-principal investigator for the Dual Ion Accelerator for Nuclear Astrophysics (DIANA) while at LBNL. Lemut will continue with the DIANA project, planned for SURF. “In the short term, I foresee the opening of new research possibilities at the DIANA facility,” said Professor Lemut, adding that DIANA is designed to attack the three nuclear astrophysics fundamental questions, including the source of solar neutrinos and the metallicity of the sun.

At SDSMT, Luke Corwin will continue his involvement with NOvA and pursue analyses of neutrinos from the beam generated at Fermilab and from natural sources. He will join the LBNE, planned for SURF and Fermilab.

At Fermilab, Corwin was also a member of the MINOS collaboration, leading a project that has combined the results from beam and atmospheric neutrino data into the world’s best instruments. “I will extend these projects into exploiting the atmospheric capabilities of the NOvA experiment and planned LBNE experiment while vigorously pursuing the most interesting beam neutrino analyses on these experiments,” Corwin said.

Ryan Martin, most recently a Postdoctoral Fellow of LBNL, is a member of the SNO and MAJORANA

collaborations. He has worked closely with Sanford Lab on the MAJORANA DEMONSTRATOR (MJD) project for several years. The MJD experiment at SURF will search for neutrinoless double beta decay using high purity germanium detectors, and aims to determine whether neutrinos are their own anti-particle and, if so, measure their mass.

Joel Sander has been a member of the Super Cryogenic Dark Matter Search experiment (SuperCDMS), working as a Postdoctoral Research Associate at Texas A&M University. SuperCDMS is an experiment to detect dark matter particles (WIMPs) that interact in cryogenic germanium detectors.

They will share their personal insights and experiences as Professors in a new doctoral physics program in future issues of the SURF newsletter.

South Dakota Governor Dennis Daugaard and the State Legislature approved the doctoral program earlier this year. Eventually, the program will include 40 students.

### **Copper Electroforming at the SURF 4850 Level**

For the past few years, Cabot-Ann Christofferson, a SDSMT Instructor and Liaison/Deputy Director of the MJD Project, has been supervising Materials Science PhD student Anne-Marie Suriano. Suriano is part of a team that has been electroforming copper at Sanford Lab's 4850 Level. The copper is free of radioactive impurities such as uranium and thorium so that using it in structural components of the MJD apparatus ensures low background in its detector elements.

The MJD copper electroforming has been taking place in the temporary clean room (TCR) on the SURF 4850 Level. The TCR has been running for almost three years now, and has gone through many updates due to its temporary design. Copper slugs are dissolved in acid baths, and then an electric current is run through the baths. Copper atoms adhere to the stainless steel cylindrical forms or mandrels, to a thickness of about 5/8 of an inch (shown in Figure 2).

With the help of project members from *Pacific Northwest National Laboratory* (PNNL), all HEPA filters on the wall of the TCR have been replaced. These are the main components responsible for

keeping mine dust out of the cleanroom. To battle the one-mile underground heat and humidity, four out of six AC units (one shown in Figure 3) have recently been replaced, and a new ventilation fan has been added to create airflow behind the TCR; this keeps the inside temperature at a comfortable 76° F.



*Figure 2: Copper growing on a mandrel that has been remachined at the Davis Campus*



*Figure 3: Preparing an AC unit to be replaced by covering it with plastic prevents outside particles from entering the cleanroom*

The last round of mandrels to be set in the electroforming baths has just been completed, which means that about one year remains of further copper electroforming at the TCR. Sometimes the mandrels are sent over partway through the growing process to the underground machine shop at Sanford Lab's Davis Campus to receive intermediate smoothing out of the surface before being reset to continue growing. This insures a continuous even growth that speeds the process along. Once the copper has completed growing, it is sent back over to Davis where it is machined into the necessary pieces, and then chemically cleaned in the Davis wet lab. From large shielding pieces to small fixtures or electronic clips, many copper parts for MJD have already finished this process and are being assembled into cryostats, and put into the glovebox to contain the detectors.

## Reports/Papers Available

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

Paper: [“The Large Underground Xenon \(LUX\) Experiment”](#). *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*, Vol. 704, 11 March 2013, pp. 111–126.

[Why the US Needs a Deep Domestic Research Facility](#). (Kevin Lesko, April 1, Cornell University Library, <http://arxiv.org/abs/1304.0402>)

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

BBC: [Science Club](#) (August 22, a clip on LUX and Sanford Lab)

Science: [At an Impasse, U.S. Particle Physicists Gather by the River to Plan and Dream](#) (Adrian Cho, July 26)

Symmetry: [Scientists look to next decades in US particle physics](#) (Kelen Tuttle, July 29)

Keloland TV: [Into The Dark At Sanford Lab](#) (Derek Olson, August 12)

Rapid City Journal: [Good, BAD & UGLY: What does dark matter look like](#) (August 19)

[Photo exhibit yields visual clues to deep underground science lab](#) (Tom Griffith, August 12)

[BHSU students spend summer taking advantage of experiential learning opportunities](#) (July 26)

[New member named to board overseeing Sanford Lab](#) (July 17)

Black Hills Pioneer (Wendy Pitick): [Sanford Lab, Chamber could join forces for combined Visitor's Center](#) (August 20)

[Sanford Lab submits \\$20M budget](#) (August 10)

[Sanford Lab offers valuable opportunities for science interns](#) (August 1)

[Neutrino Day sheds light on dark matter](#) (Adam Hurlburt, July 16)

[Sanford Lab shaft rehab ahead of schedule](#) (July 15)

[Science through Art and Music](#) (July 13)

## 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

### Artists Explore Dark Matter

In conjunction with Neutrino Day, the Lead Deadwood Arts Center hosted an open house on July 22 to present its latest art gallery exhibit: “Into the Dark: Artists Exploring Dark Matter.” The exhibit features twenty-two South Dakota artists presenting their artistic interpretation of dark matter using various art media (shown in Figures 4-6). Also on display is “Deep Photography,” a photographic chronicle of building an underground laboratory by Steve Babbitt of Black Hills State University and Matt Kapust of Sanford Lab. The artwork and photography will remain on display through the summer. In the fall, the exhibit will go on tour at various venues in South Dakota.



Figure 4: The colors in these ultra-pure copper shavings remain a mystery, says photographer Matt Kapust



Figure 5: This diamond drill borehole is only eight inches in diameter but in Matt Kapust's photo it looks like a tunnel. The photo also reveals information about rock stresses.



Figure 6: Surveyors cast shadows in the 4850 Level Davis Cavern in Steve Babbitt's photo

### Ross Shaft update

The five-year project to replace steel supports in the 5000-foot Ross Shaft began one year ago. The shaft, constructed in the early 1930s, is supported by steel I-beam frames or sets, every six feet. The new tubular steel is assembled in 18-foot sets.

As of mid-August, new steel has been installed to just above the 800-foot level. The crews are slightly ahead of schedule, according to Underground Access Director Will McElroy. The refurbished Ross Shaft will be used for construction of new, larger underground experiments such as the proposed Long-Baseline Neutrino Experiment.

Installing the steel is a multi-step, precision process. As shown in Figure 7, Infrastructure Tech Talon Tucker is using a chain saw to cut or "gad" rock from a "rib" in the shaft. (A gad is a rock chisel, and rib is a mining word for a rock wall.) The new steel sets are hung from bearing beams that rest on saddles anchored in the rock. Technicians also use air-driven gadding hammers, jackleg drills, and a tool

called a micro-blaster, which moves small amounts of rock by exploding black-powder charges. Barriers prevent the rock from falling down the shaft.



Figure 7: Infrastructure Tech Talon Tucker uses a chainsaw to cut or "gad" rock in the Ross Shaft

### Sanford Lab Safety Perception Survey

Sanford Lab conducted its first Safety Perception Survey in July. **Senior Safety Specialist James Hopmeier** reported that 101 people participated out of the 135 who received the written survey. The four-page questionnaire asked a range of questions. Respondents were asked to rank activities in order of importance, and then they were asked to rank those same activities in the order they perceive that supervisors would rank them.

The results revealed good news as well as areas for improvement. Among the preliminary results, Hopmeier reported:

- Eighty percent of respondents had a "positive perception" of safety at the Sanford Lab
- Thirteen percent had a "neutral perception"
- Six percent had a "negative perception"

Looking closer at the results, Hopmeier found that the statement earning the "least positive" response was: "Sanford Lab's leadership understands the challenges associated with performing my job." While 64 percent agreed with the statement, 19 percent disagreed and 14 percent were neutral. "As an organization, one way to improve this particular perception is for leadership to spend more time in the field learning about the challenges inherent in our operations," Hopmeier said. In response, Sanford Lab Director Mike Headley already has created a program to make sure that managers and supervisors spend more time in the field listening to employees, talking to them about the challenges they face, and taking action to correct problems.

The statement that earned the most positive response was: "I'm empowered to protect myself and my coworkers through my actions while at work." An overwhelming majority of 96 percent agreed with this statement, and the rest were neutral. No one disagreed.

"These numbers are good, but we can do better," Hopmeier says. "Attitudes and perceptions are important when it comes to safety. Research suggests that perceptions might even help predict behavior. If safety is perceived as poor, that might indicate employees are more likely to take shortcuts or take risks that could lead to accidents."

Hopmeier believes that in general, Sanford Lab staff should be proud of the overall perception that the SURF facility is a safe place to work. "This is the result of the efforts of the vast majority of our coworkers, who are focused on quality work done in a safe and professional manner," he said.

The Sanford Lab Safety Committee and the Environment, Health and Safety Department are working on a more detailed analysis of the survey. "Once that is completed, we will share what we learn," Hopmeier said. "Watch for new initiatives. As positive as these results are, we will continue to make very attempt to improve. We must all remain vigilant to make sure everyone returns home safely at the end of each shift."

### EDUCATION AND OUTREACH

#### Davis-Bahcall Scholars

In July, the Davis-Bahcall Scholars (shown in Figure 8) were onsite at Sanford Lab for two weeks before traveling to Italy and the Chicago area. They returned home on August 4.

The first week at Sanford Lab consisted primarily of background lectures by SURF E&O Deputy Director Peggy Norris and Drew Alton (Augustana College). The scholars also visited physics and genomics laboratories at BHSU with Kara Keeter, Brianna Mount and Cynthia Anderson, and toured SURF's Wastewater Treatment Plant with Jim Whitlock and Duane Ennis. At the end of the week, the scholars prepared and presented science activities as part of Neutrino Day.



*Figure 8: 2013 Davis-Bahcall Scholars (Back row, from left): Zach Crandall (Britton), Dan Ostraat (Canton), Eric Roach (Sioux Falls), Lia Meirose (Sturgis), Dakotah Simpson (Lead). (Front row, from left): Rashyll Leonard (Montrose, CO), Karen Lee (Aberdeen), Adrian del Grosso (Huron), Rachel Nevin (Sioux Falls)*

The second week included lectures from LUX (Curt Nehr Korn, Brown) and MJD (Mary Kidd, Tennessee Tech), as well as a visit to the Center for Theoretical Underground Physics Neutrino workshop (held at Lead-Deadwood Middle School), where scholars heard a lecture on neutrinos from Boris Kayser of Fermilab. Jason Jorgenson and Mike Brandt visited the group from the 3M Aberdeen and Brookings plants, respectively, to tell the students about opportunities with the company, and SURF project engineers Dave Taylor, Bryce Pietzyk, and Andrew Brosnahan took part in an engineering careers panel discussion. On Thursday of that week, the students went underground to set up muon detectors and tour the Davis campus. On Friday, they toured the SDSMT biofuels laboratory with Professor Rajesh Sani and attended a physics talk by Professor Xinhua Bai.

For the travel portion of the program, the students were accompanied by Rose Emanuel, a Lead-Deadwood high school science teacher. The group visited Gran Sasso and Frascati National Laboratories in Italy, and Fermilab, Argonne National Lab, and the University of Notre Dame near the Chicago area. At Notre Dame, they spoke with 2010 Davis-Bahcall Scholar Bryce Frentz, who was interning in nuclear science with Ani Aprahamian. Students wrote blogs about their experience, which can be seen at: [2013DavisBahcall.blogspot.com](http://2013DavisBahcall.blogspot.com).



### 2013 Summer Interns Report

The SDSTA Board funded four 10-week Dave Bozied Internships for South Dakota undergraduates in 2013. Ashley Wingert (BHSU) and Sophia Elia (UC Berkeley) worked in the Science Department, spending most of the summer underground. Bennett Prosser (SDSMT) worked in surface operations with Dan Regan and Tim Baumgartner, and Anna Hafele (BHSU) worked with the Education and Outreach Department. The students quickly became contributing members of the various departments, and will be missed now that they are returning to their respective campuses.

In addition, with funding through BHSU, the Communications Department was able to hire Laura Howard (BHSU), who contributed greatly to making Neutrino Day a success. Two other students, Dakotah Simpson (Lead, SD) and Conrad Farnsworth (Newcastle, WY), both entering SDSMT this Fall as Electrical Engineering majors, worked for five weeks each, splitting their time between working on instrumentation and control systems with Chuck Lichtenwalner in the EH&S Department and with Peggy Norris in the Education Department.

Some of the interns reported on their experience in the SURF July newsletter. Two others share their experiences here.

#### Sophia Elia

Donning a hard hat, pulling on my coveralls, and strapping on my headlamp was just the start to my day this summer as a science intern at SURF. Every morning I'd catch the 7:30 a.m. cage with a continually shifting group of scientists from around the world. Beyond that, I couldn't tell with any certainty what I'd be doing.

My job was to assist whoever needed it. Primarily, I worked with the LUX team, and throughout the course of the summer, I became trained and helped run many of the systems integral to the operation of the detector. For the first seven weeks of my internship, I spent a lot of time using the sampling system in the Lower Davis Cavern to analyze the purity of the xenon in the detector. This task became even more important during periods when the xenon could take a purity hit: after a power outage or a stop

in circulation. I also learned how to monitor the liquid nitrogen system that keeps LUX cool. I assisted on krypton and californium injections, did thermosyphon, gas, and water system checks, and helped with the replacement of the high voltage crates for the water PMTs.

I was very lucky that the scientists from LUX treated me as though I was another shifter, which enabled me to have real responsibilities and feel as though I was making a valid contribution to the upkeep of the experiment. My understanding of the detector deepened immeasurably, and having the chance to physically work with the different systems has been immensely helpful. As a student just beginning to embark on the path to becoming a fully-fledged scientist, this experience has been encouraging and rewarding.

I now understand what it's like to work day in and day out on an experiment. I didn't realize before this summer how often problems can arise and how much effort it takes to fix them. During the seventh week of my internship, a network cable was cut in the mine shaft, and all communication with the underground was lost. I spent two nights working the graveyard shift to help provide 24/7 monitoring of the detector. Running an experiment like LUX takes a great deal of dedication, and I was constantly impressed by the workload the on-site scientists took on.

The best part of my internship was getting the chance to interact with all of the people at Sanford Lab. As I move forward into my second year at Cal, the friendships, experiences, and knowledge that I have gained this summer will serve as continual motivation. I would like to thank everyone who made this opportunity possible for me; I'll carry these memories with me for the rest of my life.

#### Laura Howard

As an intern with the Communications Department, I have had a different experience than most students who intern at Sanford Lab. My main task for the majority of the summer was helping with Neutrino Day. I helped design and print flyers, signs, and banners that were distributed and hung up throughout Lead and the Northern Hills. I also redesigned the "Nerds Searching for WIMPs" T-shirts and the Neutrino Day T-shirts. One of the main things I have learned from this internship is how to

work with others who have very different opinions about how something should be done. It is easy to design something when you are the only person providing input, but when you add more people to the mix, it becomes much more challenging. Finding solutions where all parties are satisfied is difficult to achieve, but possible when you are respectful of each other's opinions, and usually things turn out better than what you could have come up with on your own. That experience alone, learning how to work as a team in a professional setting, has been invaluable to me. In addition to seeing a growth in my designing skills, I have also seen a major improvement in my photography skills. The Lab is a challenging environment to take good photos in, but with Matt Kapust's guidance and instruction, plus actual experience underground, I have seen much improvement. Neutrino Day also provided me with more experience as a photographer as I went from event to event chronicling the day. The lighting and layouts changed dramatically from one event to another, and I had to adjust and react quickly. It was an exhausting but rewarding experience. Many of the photos from that event, plus others I have taken over the course of the summer, have been used on the Sanford Lab website, in the monthly SURF newsletter, and the weekly *Deep Thoughts* newsletter. This internship has certainly changed my life, and I am very grateful to have had an amazing experience working among such diverse and talented individuals.

### Upcoming Events

On September 17, from 5-7 p.m., Sanford Lab will be hosting a Chamber of Commerce Mixer and panel discussion as part of the South Dakota Festival of Books, which comes to Deadwood on alternate years. The event will celebrate the Fiftieth anniversary of Ray Davis' proposal to measure solar neutrinos in the Homestake Mine. Former Homestake employee Steve Mitchell, author of *Nuggets to Neutrinos*, will be the featured presenter. All are invited.

### ENVIRONMENT, HEALTH & SAFETY



#### Bicycling Safety

- Always wear a helmet.

- Follow the rules of the road, and obey all traffic signs and signals.
- Keep your eyes on the road ahead. Avoid running over potholes, gravel, broken glass, drainage grates, or other unsafe road conditions.

### STAFF NEWS



#### In Memoriam - Chris Bauer

We are sorry to report that Chris Bauer, a SURF Electrical Safety Engineer, passed away on July 28 after an 18-month battle with cancer. Bauer joined Sanford Lab in March 2010. He earned his BS in Electrical Engineering in 1985 from South Dakota School of Mines and Technology, and began his professional career at the US Army Corps of Engineers in Omaha. In 1986, he joined his father's electrical contracting firm, *Bauer Electric* in Yankton, SD, which he operated for 17 years. In 2004, he became the Electrical Engineer for *Menu Foods* of Ontario, Canada before joining Sanford Lab.

"Chris was an amazing person in many ways," Laboratory Director Mike Headley wrote to the staff. "He fought a terrible disease with an incredible level of courage and grace. He always kept his sense of humor throughout the very difficult times he faced these past months." An example of this humor is shown in the above picture of Chris. He had colored his hair blue in advance of a round of chemotherapy, as he figured he would lose it soon anyway.

In June, Chris assisted in organizing the underground video event between Sanford Lab and 115 people in Yankton, SD, on the eastern side of the State.

Chris loved to spend time with his wife Julianne and two daughters, Tessanna and Emmalynn. He was involved in his daughters' activities of swim and dance, did carpentry work at home, and loved long-distance running. In 2011, Chris, as a master's division runner, ranked nationally in the steeplechase and won the inaugural Crazy Horse Half Marathon in Custer, SD.

In lieu of flowers, memorials can be sent to the Chris Bauer Internship at SURF, 630 East Summit Street, Lead, SD 57754.



*Chris with his father Jim, who visited Sanford Lab in June 2012*

### UPCOMING CONFERENCES AND WORKSHOPS

**Town meeting for the 2<sup>nd</sup>-phase development of the China Jinping Underground Lab.** Asilomar, CA, September 8, 2013. US Contact: Wick Haxton [haxton@berkeley.edu](mailto:haxton@berkeley.edu)

**TAUP2013, 13th International Conference on Topics in Astroparticle and Underground Physics,** Asilomar, CA, Sept 9-13. Covers recent experimental and theoretical developments in astroparticle physics.  
<http://taup2013.lbl.gov>

**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>

**Fall 2013 Meeting of the APS DNP,** Newport News, VA, Marriott Hotel and Conference Center, October 23-26, 2013.  
<https://www.jlab.org/conferences/dnp2013/dnp-13.html>

**NNN13: International Workshop on Next Generation Nucleon Decay and Neutrino Detectors,** Kavli IPMU, Tokyo, Japan, November 10-13, 2013.  
<http://indico.ipmu.jp/indico/conferenceDisplay.py?confId=1>



### JOBS

**Communications Director, Sanford Lab, Lead, South Dakota.** Lead SDSTA's communications program in support of Sanford Underground Research Facility activities. Develop, maintain, and execute communications plans. Lead Communications Department team in representing Sanford Underground Research Facility as a premier underground science facility. To apply or read more: <http://www.sanfordlab.org/careers>

**Postdoctoral Fellow, Lawrence Berkeley National Lab, Nuclear Science Division.** Work on neutrinoless double-beta decay search in the MAJORANA Experiment. Alan Poon.  
[awpoon@lbl.gov](mailto:awpoon@lbl.gov)  
<https://lbl.taleo.net/careersection/2/jobdetail.ftl?lang=en&job=76244>

**Faculty positions, University of California, Berkeley.** Two tenure-track Physics Dept. faculty positions to start July 2014. Deadline: 11/8/13. Sarah Wittmer [switt@berkeley.edu](mailto:switt@berkeley.edu)  
Astroparticle Experiment (direct dark matter detection): <https://aprecruit.berkeley.edu/apply/JPF00197>  
AMO Science (emphasis on theory): <https://aprecruit.berkeley.edu/apply/JPF00196>

**Postdoctoral Fellowships, LBNL, Berkeley.** Chamberlain Fellow in experimental particle physics and cosmology. Deadline: 10/15/13.  
<https://academicjobsonline.org/ajo/jobs/2931>

**Postdoctoral position, University of Alabama, Tuscaloosa.** Work on EXO experiment in nuclear physics group. Closing date: 12/1/13. Andreas Piepke, [andreas@bama.ua.edu](mailto:andreas@bama.ua.edu).  
<https://facultyjobs.ua.edu/postings/30762>

**Postdoctoral Researchers, Southern Methodist University, Dallas, TX.** Work on the SuperCDMS experiment. Jodi Cooley. [cooley@physics.smu.edu](mailto:cooley@physics.smu.edu)  
<http://www.physics.smu.edu/cooley/cdms/>



**Assistant Professor, Rensselaer Polytechnic, Troy, NY.** Tenure-track position in Experimental Particle/Nuclear Astrophysics researching double-beta decay, direct or indirect detection of dark matter. Deadline: 10/20/13. Joan Perras, [perraj@rpi.edu](mailto:perraj@rpi.edu)  
[www.rpi.edu/dept/phys/faculty/searches.html](http://www.rpi.edu/dept/phys/faculty/searches.html)

**Postdoctoral Positions in Geobiology/Astrobiology, Univ. of Southern California.** Research at NASA Astrobiology Institute in general area of subsurface microbiology. Jan Amend [janamend@usc.edu](mailto:janamend@usc.edu)  
<http://astrobiology2.arc.nasa.gov/careers/postdoctoral-positions-in-geobiology-astrobiology-at-university-of-southern-california/>

**Staff/Assistant Research Scientist, Geobiology Logistics/Laboratory Manager, Desert Research Institute, Las Vegas.** In Earth and Ecosystem Sciences, logistical support of NASA's new Life Underground Astrobiology Institute and Lab Manager for DRI's Environmental Microbiology Lab. Review starts 8/1/13 Job No: 0600133  
<http://www.jobs.dri.edu>

**Cosmology-Data Science Fellows, BCCP, UC Berkeley, CA.** Four or five positions from post-doctoral through senior scientist, depending on experience. Members of this group will explore a novel approach to Cosmology Data Science (CDS). Closing date: 8/30/13.  
<http://jobregister.aas.org/node/45181>

**Newsletter Editor:** Melissa Barclay

**Contributors:** Kevin Lesko; Bill Harlan (Sanford Lab local news); Anne-Marie Suriano (Copper Electroforming at the SURF 4850 Level); James Hopmeier (Sanford Lab Safety Perception Survey); Peggy Norris, Ben Saylor (Education and Outreach)

**Photo Credits:** Figs. 1,4,5,7: Matt Kapust; Figs. 2,3: Anne-Marie Suriano; Fig. 6: Steve Babbitt; Fig. 8: Laura Howard

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