

## Dear Homestake Collaboration,

Welcome to the December 2011 monthly newsletter for Homestake SURF and South Dakota's Sanford Laboratory. We gladly 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 our shared goal.

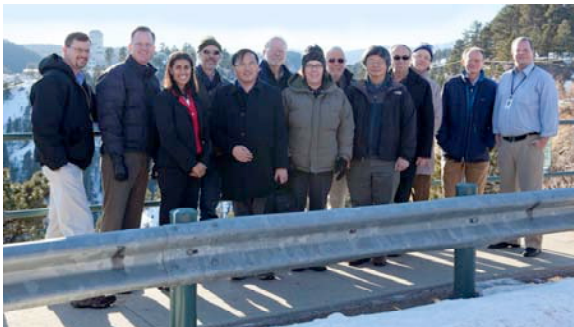
### Important Dates

**December 23-January 2: UC Berkeley/ LBNL Holiday Shutdown**

**January 19-20, 2012: Annual DURA meeting – Fermilab, Batavia, Illinois**

**January 26-27, 2012: MAJORANA DEMONSTRATOR Readiness Review – Lead, So. Dakota**

## Program Advisory Committee (PAC) Meeting



*Figure 1: PAC members met on December 14-16. Mandy Knight (third left) coordinated the meeting logistics*

With recent snow on the ground, members of the Program Advisory Committee (PAC) met in Lead, South Dakota from December 14-16. The first two days consisted of meetings, and on the last day, attendees were able to take an underground tour.

Present from the PAC were: Abe Seiden, UCSC, Committee Chair; Mike Witherell, UCSB; Heidi Schellman, Northwestern; Boris Kaiser, FNAL; and Peter Parker, Yale. Alan Caldwell from MPI and Michael Ramsey-Musolf of the University of Wisconsin participated in the discussions remotely.

The Committee heard from the SURF Project on the progress in establishing the Sanford Laboratory at the 4850 Level, and the extensive efforts to integrate the experiments into the laboratory and facilitate their operation. Future occupants of the campus--the LUX Dark Matter Experiment, the MAJORANA DEMONSTRATOR Neutrinoless Double Beta Decay experiment, and the University of South Dakota-led effort CUBED--gave presentations regarding their progress in readying their detectors for installation, as well as their anticipated scientific programs. The Committee then heard a webcast presentation on the other anticipated major physics experiment--the Long-Baseline Neutrino Experiment--from LBNE's Project Manager Jim Strait at FNAL.

On Friday, SURF Project leaders Kevin Lesko, Mike Headley, Bill Roggenthen, and Rick Labahn accompanied the Committee on a tour of the Sanford Underground Lab (shown in Figure 2) so they could witness the construction at its halfway point. Members of the PAC remarked on the very notable progress in establishing the laboratory infrastructure in the past several months, and also complimented the SURF crew on their exceptional progress. The LUX and MAJORANA experiments anticipate beginning to move into the Laboratory in March 2012, with operation of the experiments to be phased in over the subsequent months.



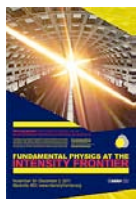
*Figure 2: Underground tour group pauses in front of the Drift from the Transition Cavern overlooking the Davis Cavern (the future entrance to LUX)*

## Long-Baseline Neutrino Experiment (LBNE) Update

At the SURF Program Advisory Committee meeting on December 14-16, LBNE's Project Manager, Jim Strait presented a report to the PAC and the SURF Project regarding the progress the collaboration has made in preparing for the Department of Energy's CD-1 review.

With the assistance of SURF design and engineering staff, the LBNE project had prepared conceptual designs for three far detector options: a liquid argon detector at the 800 Level, a liquid argon detector at the 4850 Level, and a water Cherenkov detector at the 4850 Level. The SURF staff and management look forward to continuing to work with the LBNE project as it defines its technology choice and establishes the facility requirements at the SURF site.

The LBNE presentation iterated themes presented in the National Research Council (NRC) DUSEL Science Report and the DOE Marx/Reichanadter Report that LBNE's science program is world-class with major discovery potential, and that co-locating LBNE with Dark Matter and Double Beta Decay experiments significantly enhances the synergies between the experiments and boosts US leadership in physics. (To obtain either of these reports, see the link noted in SURF in the News on page 3.) The presentation also emphasized that both detector options are anticipated to deliver all the LBNE's broad physics requirements. The SURF Project looks forward to following the progress on LBNE's final technology choice, and working with LBNE as it prepares for its project reviews.



### Intensity Frontier Workshop

From November 30 to December 2, over 500 scientists converged for the workshop, "Fundamental Physics at the Intensity Frontier" held in Rockville, Maryland. One of the workshop goals was to identify the potential of the Intensity Frontier, where scientists will use high energy beams and particle detectors to explore rare subatomic processes.

The workshop was split into six working groups covering the topics of: Heavy Quarks, Charged Leptons, Neutrinos, Hidden Sector Photons, Axions, and WISPS, Proton Decay, and Nucleons/Nuclei/Atoms. Speakers from each group provided an overview of their research area and their future goals. There were also breakout sessions and time for stimulating discussions

regarding the science itself as well as possible research facilities needed for the program.

Of particular interest to SURF will be the Long-Baseline Neutrino Experiment (LBNE), which is one of the Intensity Frontier's proposed projects and experiments. One of the suggested locations for the LBNE detector is the Sanford Lab location in Lead, South Dakota. Fermilab researchers have proposed plans to place a large detector in the deep underground laboratory to study neutrinos coming from a beam generated at Fermilab.

To read first-hand accounts or find out more details about this workshop, see articles by Brad Hooker and Tona Kunz in *Fermilab Today* and *Symmetrybreaking*; also, in *SLAC Today*, by David McFarlane, Professor at SLAC National Accelerator Laboratory and Director of SLAC's Particle Physics and Astrophysics division. (Please note the article links below in SURF in the News.) A final report of the workshop results will have been completed in January 2012.

More information on the Intensity Frontier can be found at:

<http://www.fnal.gov/pub/science/experiments/intensity/experiments.html>



### SURF IN THE NEWS

**NEWS FLASH:** *Sanford Funding comes through as budget battles end* (*Rapid City Journal*, Kevin Woster, December 22)

Hidden by the controversy in Washington, D.C., over a stalled plan to extend a payroll tax cut was some good news for the Sanford Underground Laboratory at Homestake.

Both the Senate and the House have finally passed appropriations bills for the current federal fiscal year, which began Oct. 1. And included in the monstrous spending package for the federal government expected to be signed by President Barack Obama is \$15 million for Sanford included in the U.S. Department of Energy budget. To read more:

[http://rapidcityjournal.com/news/sanford-funding-comes-through-as-budget-battles-end/article\\_8d8190ee-2c53-11e1-b07b-001871e3ce6c.html](http://rapidcityjournal.com/news/sanford-funding-comes-through-as-budget-battles-end/article_8d8190ee-2c53-11e1-b07b-001871e3ce6c.html)

*Fermilab Today: Director's Corner: A good close to the year* - The final important event from last week was the next step on the path to the Long-Baseline Neutrino Experiment (LBNE) - a recommendation from the executive committee of the LBNE collaboration regarding how the experiment should be done. To read more:

<http://www.fnal.gov/pub/today/> (December 20)

*Symmetrybreaking: First physics experiments soon to move into former Homestake mine* (Article by Sanford Lab Communications Director Bill Harlan, December 15). See <http://t.co/oUXef47v> and article summary on page 4

Inside Science.org: *In Era of Constrained Budgets, Basic Research Remains Critical for Nation's Prosperity* (William Brinkman, November 28)

*AIP Bulletin of Science Policy News: Bill Brinkman on Support for Basic Research* (December 8)

*Fermilab Today and Symmetrybreaking: DC Workshop envisions the Intensity Frontier* (Brad Hooker, November 29) and *DOE's Intensity Frontier Workshop packed with ideas and people* (Tona Kunz, December 5)

[http://www.fnal.gov/pub/today/archive\\_2011/today11-11-29\\_IntensityFrontierReadMore.html](http://www.fnal.gov/pub/today/archive_2011/today11-11-29_IntensityFrontierReadMore.html)

[http://www.fnal.gov/pub/today/archive\\_2011/today11-12-05\\_IFReadMore.html](http://www.fnal.gov/pub/today/archive_2011/today11-12-05_IFReadMore.html)

SLAC News Center: *The Rich Fabric of Intensity Frontier Physics* (David McFarlane, December 9) <https://news.slac.stanford.edu/features/director-particle-physics-and-astrophysics-rich-fabric-intensity-frontier-physics>

*Rapid City Journal: Universities awarded scientific research grants* (Staff, November 11); *SciGirls to meet in Lead* (Staff, November 16); *Local club aims to get girls involved in science* (Joe Kavanaugh, November 19); *Students raise money to fund visit by musher* (Lynn Taylor Rick, November 29): An article about Sanford Lab's Connie Giroux. To read more about Connie, see page 6.

*Black Hills Pioneer* (Wendy Pitlick): *Transforming a mine* (November 9); *Lab main topic at national physics workshop* (December 1)

Aberdeennews.com: *South Dakota: Scholarships available for young scientists* (November 21)

*APS News (The Back Page): The Economics of Education: Closing Undergraduate Physics Programs*. Proposals are under way in several states to eliminate undergraduate Physics programs. (Theodore Hodapp, December 8)

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

**Reports Available:** The National Research Council report *An Assessment of the Deep Underground Science and Engineering Laboratory* can be ordered at: <http://t.co/i3PAfPz>

The Marx-Reichanadter Committee report to DOE can be found at:

[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)

### DURA NEWS

*DURA meeting and DURA Election:* Derek Elsworth and Hank Sobel will be rotating off the DURA Executive committee. The committee is slated to have nine members total, so an election will be held to add one member to the committee for the coming year. Beginning in 2012, DURA will routinely replace three members. The larger number of current members is due to the evolution of the DEDC into DURA. This transition will be complete after this upcoming election. Please think about those you may wish to nominate. The election will be held in December.

The DURA membership will also be asked to vote on a name change for the organization. It is now titled the DUSEL Research Association (DURA). Since DUSEL will no longer be used as a name for the underground facility, one proposed name change is Deep Underground Research Association (DURA). The goal is to keep the present acronym. A yes/no vote on this topic will be part of the election.

*The 12<sup>th</sup> Congress of the International Society for Rock Mechanics (ISRM) and concurrent Underground Research Laboratories (URL) Workshop:* During the week of October 17-21, DURA members met in Beijing, China to participate in and organize a workshop Congress of the new ISRM Commissions on URL Networking, Coupled Processes, and Petroleum Geomechanics. North American workshop contributors, presenters, and

Congress speakers included: Tom Doe, Maurice Dusseault, Derek Elsworth, Marte Gutierrez, Peter Kaiser, Chris Laughton, Jonny Rutqvist, Peter Smeallie, Azra Tutuncu, and Joe Wang. Montreal, Canada will host the 13<sup>th</sup> ISRM Congress scheduled for 2015. More information on the workshop can be found at:

<http://www.isrm2011.com/upload/shortcourse/WS5.pdf>

*American Geophysical Union (AGU) Fall meeting:*

The AGU meeting was held December 5-9 in San Francisco. Sessions organized and attended by DURA members included: Novel Microbial Processes in the Deep Biosphere; Fractures, Fracture Networks, and Fractured Media Field- and Fault-Scale Studies; Heterogeneity and Geologic Storage of CO<sub>2</sub>; Natural and Enhanced Geothermal Systems: Characterization, Integration, Stimulation, Simulation, and Induced Seismicity Risk; Coupled Physical and Chemical Transformations Affecting the Performance of Geenergy Systems; and Correlation and Coupling from Underground, Surface, to the Ionosphere. For more information on this meeting: <http://www.agu.org/meetings/>

## SANFORD UNDERGROUND LABORATORY NEWS

### Dewatering Levels



*Figure 3: Progress of dewatering at Sanford Lab*

The Figure 3 graphic above indicates the dewatering progress made at Sanford Lab. As of December 14, the water level was at 5750 feet, its lowest point ever. The high water mark, in August 2008, was at 4350 feet underground.

### Davis Campus - Update

Project Engineer Rick Labahn is directing the outfitting of the Davis Campus at the 4850 Level in preparation for the Large Underground Xenon (LUX) and MAJORANA DEMONSTRATOR (MJD) experiments. He reports that the following quantity of

materials will be used for the project by the scheduled completion date of March 2012.

- 29 tons of rebar
- 525 cubic yards of concrete
- 2000 cubic yards of fill material
- 13,000 cement blocks
- 80,000 lbs. spiral ductwork
- 75,000 lbs. rectangular ductwork
- 7 miles of conduit
- 30 miles of wire

Most of that material has already been delivered underground, including the six largest structural steel beams. Over 50 beams total--ranging in size from short connectors just a few feet long to the longest beams at 28 to 32 feet long--will be used to construct the top floor of the LUX laboratory. The smaller beams were transported underground in the Yates Shaft work deck, but Sanford Lab technicians had to sling the large beams underneath the Yates Shaft deck in order to deliver them to the 4850 Level.



*Figure 4: Project Engineer Rick Labahn (right) and Education and Outreach Director Ben Saylor inspect the temporary gantry at Davis Campus*

Ainsworth-Benning Construction (ABC) of Spearfish, South Dakota has assembled a temporary construction gantry (see Figure 4) at the Davis Campus. The gantry will be used to help maneuver the structural steel beams into place. The gantry will eventually be higher after another set of steel supports is added to the bottom of the structure.

Once in place, the beams will rest on saddles secured to the walls of the cavern to form a grid that will support a steel deck for LUX's top floor.



*Figure 5: At the Transition Cavern: Computer Science Professor Steve Graham of Dakota State University is helping to build a virtual Sanford Lab. The I beams behind him will eventually be moved to the Davis Cavern*

A steel staircase will provide access to the first floor. The LUX detector will eventually be lowered into a stainless steel water tank on the first floor. The 71,600-gallon tank, which will protect the LUX dark-matter detector from background gamma radiation and neutrons, measures 20 feet high and 25 feet in diameter. The water tank has already been delivered (in pieces) to the 4850 Level.

SFI, the tank fabricator crew from Conway, Arkansas, arrived on site mid-December to weld the tank together. As of mid-December, the top of the circular water tank had already been laid out on the floor of the Davis Cavern. (This circle can be seen on the floor shown in Figure 4.)



*Figure 6: A new Yates cage was installed on December 14 (More details in the January issue!)*

As of early December, ABC had poured all of the concrete floors, built about half of the block walls, and started installation of ductwork.

## Fire Safety at Davis Campus

By the time construction is completed and the experiments are ready to begin, a number of fire-safety systems will be in place in the Davis Campus. Contractor Rapid Fire Protection has installed the main sprinkler system in the Transition Cavern.



*Figure 7: Rick Labahn points out the tight seam between a block wall and a shotcreted rock wall in the MAJORANA DEMONSTRATOR laboratory*

To build a fire-barrier wall and ensure safety, masons cut the cement wall blocks for a tight fit (see Figure 7), and the blocks were then secured to the rock with rebar. A layer of grout was added to the seam.

During normal operations, three large air handles will provide filtered air to the clean lab spaces. Much of that air will be recycled, but in case of fire, the system will automatically switch to 100 percent fresh air so that all the interior air, along with smoke, would be exhausted.

## MAJORANA DEMONSTRATOR Copper Update

As of mid-December, the MJD team has manufactured more than 20 percent of the 5000 pounds of radiation-free copper that will be needed to shield the experiment and hold in place the enriched germanium crystals used in the neutrinoless double-beta decay search.

## EDUCATION AND OUTREACH

*Onsite programming:* Black Hills Special Services combined a tour of the Black Hills Mining Museum with a visit to the Sanford Lab on November 30. GED students and teachers learned about the Davis neutrino experiment and how it led to the plans for experiments at SURF and the establishment of Sanford Underground Lab. They toured the Hoist Room and talked about the role of the Waste Water Treatment Plant.

*Videoconferencing:* The high definition video equipment donated to the Education and Outreach Department has seen increasing use, both to receive and present programming. On November 22, 42 sixth-graders from Deb Thorp's science class at Lead-Deadwood Middle School came to the Yates

Education Building for a talk on nanotechnology, presented by researcher David Gottfried, of the Nanotechnology Research Center at Georgia Tech. Students also participated in a science experiment together with David, facilitated locally by Julie Dahl.

On December 1, SURF/Sanford Lab staff participated in a web conference on engineering careers, presented to approximately 50 middle and high school students in western Pennsylvania. Communications Director Bill Harlan gave an overview of activities at Sanford Laboratory. Project Engineer David Taylor and Systems Engineering Lead Steve Acheson talked about career paths for the subfields of mechanical and systems engineering, respectively, including discussions of their own career journeys and what they do at Sanford Lab.



*Figure 8: Peggy Norris (center in blue shirt) with members of the Science Club at Red Cloud Indian School on the Pine Ridge Reservation. Cultural Outreach Coordinator KC Russell (in back), Julie Dahl (just right of Norris) and Connie Giroux (right)*

Science Liaison Laboratory Supervisor Connie Giroux (seen above in Figure 8) earned a bachelor's degree in chemistry and has a master's in technology management from South Dakota School of Mines and Technology. She is a Rosebud Sioux Tribe member who has been giving back to the community by participating in Sanford Lab outreach programs, especially to area schools and reservations. As mentioned on page 3, Rapid City Journal education reporter Lynn Taylor Rick wrote a column about Connie, and her inspirational mentoring role.

Sanford Lab Education Specialist Julie Dahl is working with Deputy Education and Outreach Director Peggy Norris to provide imaginative ways to link advanced underground research, such as the search for dark matter or neutrinoless double beta decay, to science curricula in the schools.

One mission of the Education and Outreach Program is to present underground science in a way that will interest students in science and engineering. Norris started the SciGirls Clubs in Lead and Rapid City to interest girls in science at an early age.

The Education and Outreach program has been successful at linking students with scientists, such as South Dakota School of Mines microbiologists Rajesh Sani and Sudhir Kumar, who joined an outreach trip to Crow Creek and Lower Brule (see Figure 9). LUX Physicist Sergei Uvarov (UC Davis) and Sanford Lab water-treatment consultant Jim Whitlock also went on this field trip.



*Figure 9: Students discovered that Lower Brule Academic Counselor Phil Meyers, who was undergoing treatment for cancer, was slightly radioactive*

## ENVIRONMENT, HEALTH & SAFETY



### Holiday Safety

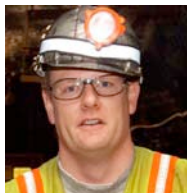
New Year's is a time to celebrate, whether you go out or stay at home.

- If you drink, don't drive. Have a designated driver or take a cab, if needed. Be conscious of other drivers on the road.
- Practice safety if you are setting off fireworks. Keep your pets indoors or in a separate room so they don't become scared or hurt.
- *Happy New Year!*

If you are visiting South Dakota, contact (605) 722-0002 for road closure and weather information or check [Safe Travel USA](http://SafeTravelUSA.com).

**Safety pages on Sanford Lab website:** [www.sanfordlab.org](http://www.sanfordlab.org) - Use the left hand menu to open individual pages

## STAFF NEWS



**Will McElroy** has been assigned as Project Manager for the implementation of the Ross Shaft Rehabilitation Project, effective December 9. All the steel in the 5000-foot shaft will be replaced. McElroy and his team will gather engineering data, arrange for the steel and other material delivery, and purchase specialty tools such as shears and jib cranes.

**Greg King** and other Ops managers will take on Will's former duties as Deputy Director for Operations during this transition. The position will not be refilled.

**George Vandine** will serve as Underground Technical Support Lead providing the daily work direction with the crews working with the Ross Shaft, and he will report to McElroy. George will also be responsible for coordination of Ross Shaft activities for maintenance and the execution of steel replacement, among other duties.

## UPCOMING EVENTS AND ANNOUNCEMENTS

### Conferences and Workshops

**American Physical Society (APS) March meeting 2012** - February 27-March 2, 2012, Boston Convention Center, Boston, MA. Scientific sessions, Tutorials and workshops, and Exhibit Hall. For registration, abstract submission, and general info: <http://www.aps.org/meetings/march/>

**APS April meeting** – March 31-April 3, 2012. Hyatt Regency, Atlanta, GA. Held jointly with the Sherwood Fusion Theory Conference for Divisions of Astrophysics, Computational Physics, Nuclear Physics, Particles and Fields, Physics of Beams, and Plasma Physics. For more info: <http://www.aps.org/meetings/april/index.cfm>

**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

### DURA Annual Meeting Scheduled for January 19-20, 2012

The annual meeting of the DUSEL Research Association (DURA) will be held at Fermilab National Accelerator Laboratory on January 19-20, 2012. The tentative agenda anticipates presentations on the future of the South Dakota laboratory, overviews of underground research around the world, and developments in underground research in the U.S. A final agenda will be posted as it becomes available closer to the meeting date.

Please send information regarding upcoming meetings of interest or presentations from DuRA members, as well as other related events to Steve Elliott ([elliotts@lanl.gov](mailto:elliotts@lanl.gov)), Duane Moser ([Duane.Moser@dri.edu](mailto:Duane.Moser@dri.edu)) or Joe Wang ([jswang@lbl.gov](mailto:jswang@lbl.gov)).



## JOBS

**Postdoctoral Fellow, Experimental Neutrino Physics, MAJORANA group, Lawrence Berkeley National Lab.** Participate in neutrinoless double-beta decay search in the MAJORANA experiment and direct kinematic measurement of the neutrino mass scale in the KATRIN experiment. Queries to Dr. Alan Poon ([AWPoon@lbl.gov](mailto:AWPoon@lbl.gov)). For more info: <https://lbl.taleo.net/careersection/2/jobdetail.ft?lang=en&job=73997>

**Physicist Postdoc Fellow, SNO+ Neutrino Experiment, Nuclear Science Division, Lawrence Berkeley National Lab.** SNO+ will search for the neutrinoless double-beta decay of  $^{150}\text{Nd}$ , in an effort to determine whether the neutrino is its own antiparticle. Queries to: Prof. Gabriel Orebi Gann, [GOrebiGann@lbl.gov](mailto:GOrebiGann@lbl.gov). To apply or for more info: <http://cjo.lbl.gov/positions.html?jobcode=abc&jobfield=10>, Job # 74020

**Faculty positions in Physics Dept., UC Berkeley.** Research in areas of Theoretical Condensed Matter, Experimental Astrophysics (including Dark Matter searches), Theoretical Biophysics, or Quantum Materials. To apply or find more info:

<http://www.physics.berkeley.edu> and click on "Faculty Job Listing" links at the right side bar.

**Faculty positions at CMNS, University of Maryland-College Park:** Tenured faculty, Experimental Fundamental Physics, and Assistant Professor, Elementary Particle Theory. For more info:

[https://jobs.umd.edu/applicants/jsp/shared/search/SearchResults\\_css.jsp](https://jobs.umd.edu/applicants/jsp/shared/search/SearchResults_css.jsp)

**Faculty position, Experimental Astroparticle Physics, University of Wisconsin-Madison.** Deadline: 12/31/11. For further info: [info@physics.wisc.edu](mailto:info@physics.wisc.edu) or Prof. Francis Halzen ([halzen@physics.wisc.edu](mailto:halzen@physics.wisc.edu)). Job Listing PVL# 72173. Submit applications to:

<http://www.physics.wisc.edu/apply/astroparticle-2011/>

**Postdoc position, Madrid, Spain.** Work in MultiDark/Cryogenic Dark Matter Search experiment; contribute to development of Monte Carlo background estimation, data analysis, and interpretation of the data. Contact: Dr. David G. Cerdeno, Instituto de Física Teórica (IFT-UAM/CSIC), Universidad Autónoma de Madrid, c/Nicolás Cabrera 13-15, 28049 Madrid, Spain or [Davidg.cerdeno@uam.es](mailto:Davidg.cerdeno@uam.es).

**Junior faculty position in experimental nuclear physics, Yale University.** For more info: Prof. Keith Baker, Chair of Nuclear Physics Search committee ([keith.baker@yale.edu](mailto:keith.baker@yale.edu)) or Prof. Meg Urry, Chair, Physics Dept., ([meg.urry@yale.edu](mailto:meg.urry@yale.edu)). Apply online: <https://academicjobsonline.org/ajo/jobs/765>

**Postdoctoral positions in Experimental Physics, INFN Laboratories (Italy) for non-Italian citizens under 35 years old.** For more info:

<http://www.newscientistjobs.com/jobs/job/postdoc-on-experimental-physics-italy-italy-1401308578.htm>

For fields of research, see:

[http://www.ac.infn.it/personale/exp\\_fellowships](http://www.ac.infn.it/personale/exp_fellowships)

**Postdoctoral Fellowship in microbial ecology/geobiology at Desert Research Institute's Las Vegas campus.** Deep subsurface microbiology studies at Nevada National Security site and other sites, including Sanford Lab. For

questions, contact Duane Moser, Chair, Postdoctoral Fellow-Microbial Ecology Search Committee (Phone: 702-862-5534 or [duane@moser@dri.edu](mailto:duane@moser@dri.edu)).

**Postdoctoral position, Subatomic Physics Group, University of Michigan.** Completion of upgrades to a calorimeter for neutron flux measurement and cold-beam neutron lifetime measurement at NIST. For more info, contact: Tim Chupp, [chupp@umich.edu](mailto:chupp@umich.edu).

**Assistant Professor position with research in High Energy Physics, Department of Physics, University of Cincinnati.** For more info: contact search committee at [randy.johnson@uc.edu](mailto:randy.johnson@uc.edu) or view website <http://www.physics.uc.edu>. Submit applications by 1/13/12 to <http://www.jobsatuc.com>, #211UC1009.

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**Photo Credits:** Figs. 1-4,6-8: Matt Kapust; Figs. 5,9: Bill Harlan

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