

# HOMESTAKE DUSEL AND SANFORD LABORATORY NEWSLETTER

## Dear Homestake Collaboration,

Welcome to the June 2010 monthly newsletter for Homestake DUSEL 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 the Collaboration, employment opportunities, and other highlights relevant to our shared goal.

### Important Dates

**July 6-8: LCAB/IAB meeting - Lead, South Dakota**

**July 9-11: Neutrino Weekend – Lead, South Dakota**

**July 12-15: S-4 Physics Reviews – NSF**

**July 27-28: PAC (Program Advisory Committee) Meeting – UC Berkeley**

(LNGS) in Assergi, about 80 miles north of Rome. The nearest towns are L'Aquila and Teramo. At the site of a devastating 6.3 magnitude earthquake in April 2009, the area is still recovering and rebuilding.

The underground physics laboratory, which is being used as a model for elements of the DUSEL construction, consists of three large underground chambers beneath 1400 meters of rock. The laboratory hosts approximately 750 scientists from 22 different countries, working on 15 experiments in particle physics, particle astrophysics and nuclear astrophysics.

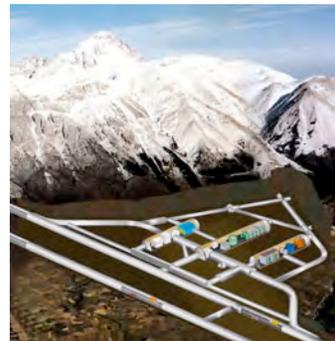


Figure 2: LNGS floor plan



Figure 1: Governor Rounds and Kevin Lesko visit Laboratori Nazionali del Gran Sasso (LNGS). From the left: Kevin Lesko, LNGS Director Lucia Votano, Governor Mike Rounds, Roberto Tartaglia, First Lady Jean Rounds.

## Visit to Gran Sasso Laboratory, Italy

On June 10, South Dakota Governor Michael Rounds and a delegation which included DUSEL Principal Investigator Dr. Kevin Lesko traveled to Italy to visit Laboratori Nazionali del Gran Sasso

DUSEL has strong ties to Gran Sasso. Scientists from Gran Sasso have visited the DUSEL project team in the United States, and members of DUSEL have visited Gran Sasso a number of times. Gran Sasso hosts the OPERA scientific experiment. Since 2006, CERN has directed a beam of muonic neutrinos from the CERN SPS accelerator to the Gran Sasso lab. Scientists on that experiment recently made the discovery of a tau neutrino obtained from the transformation of a muon neutrino, which occurred during the journey from Geneva to LNGS. This exciting new discovery on the cutting edge of neutrino physics could have a direct positive impact on the LBNE and its proposed research at DUSEL. Another area of mutual interest concerns the scientific research on dark matter.

The delegation met with Dr. Lucia Votano, Director of LNGS, Dr. Eugenio Coccia, former Director, Dr. Roberta Antolini, Head of Public Affairs, Dr. Ornella Palamara, Head of the LNGS Research Division, Dr. Dino Franciotti, Head of LNGS Technical division, Dr. Roberto Tartaglia, Head of Projection and Prevention and Local Authorities, Dr. Gianna Chiodi and Dr. Massimo Cialente. The Group discussed the educational exchange program including the South Dakota Davis Bahcall scholarships, leading edge

R&D opportunities, and shared interest in underground research. Dr. Lesko indicated he was anxious to reciprocate the warm hospitality shown to the South Dakota and DUSEL delegation and was seeking ways to expand the education and scientific collaborations.

LNGS is partnered with the South Dakota Davis-Bahcall scholarships, with students involved in an exchange program between South Dakota, Gran Sasso and Princeton. More on this program can be found in the Education and Outreach section (see page 5).

## Historic Preservation meeting



Figure 3: 1877 photo of Homestake Gold Mine

On June 9, the DUSEL Surface Campus Design Team met with the South Dakota State Historic Preservation Office (SHPO) to present an update on the on-going Surface Facilities design efforts. The DUSEL Design Team, represented by Steve Dangermond (Dangermond Keane, DUSEL Architect), Greg Hadsell (HDR Architect), Bob Mack (MacDonald and Mack, Historic Preservation), and DUSEL staff represented by Bill Roggenthen, Peggy Norris and Bob Kaufman presented an overview of the present Surface Design concept (30% PDR) to five members of the South Dakota SHPO as well as members of NSF and Argonne National Lab personnel (via phone and webex). Argonne National Lab is under contract with NSF to prepare the EIS for the DUSEL project and thus will be working directly with SD SHPO on Historic Preservation issues for the project.

One part of the site Assessment work completed by HDR was to define the historic elements of the site. Through this process, the surface buildings were classified into two categories, either “Transcendent” or “Support.” A “Transcendent” structure was one

that was crucial to the mining operation, i.e. Head frames, Hoist buildings, Crushers, Drys, etc. A “Support” was a structure that housed an operation that could have been performed off-site, i.e. Machine shop, Foundry, Sawmill, etc. The “Transcendent” structure must be retained to the maximum extent possible, whereas a “Support” may be modified or removed, if necessary, upon completion of an approved “mitigation” effort.

The presentation focused on the site development as it relates to Historic Preservation issues that have been outlined by Bob Mack and incorporated into the present design. SD SHPO was pleased with the overall plan and the tracking and addressing of issues of concern such as site massing and relating site context to the headframes. SHPO felt the design should incorporate existing material to maintain historic context and any modifications to “Transcendent” structures should be incorporated into the building interiors to keep the same exterior appearances.



Figure 4: 1888 Archival photo of mine interior

Discussion was also held on the New Sanford Center for Science Education and the need to have this new building blend in with the context of the existing structures. As this design is in the very early, conceptual stages, incorporating these concerns will assist the design team in the building development.

The meeting closed with a brief discussion on the Underground. Since the old / historic condition of the Underground was a mine environment, it does not conform to a modern, OSHA acceptable environment. The upgrades necessary to meet the DUSEL needs will not retain the mining atmosphere, thus SHPO gave a number of suggestions that are acceptable mitigation efforts that allow the project to move forward but at the same time meet the National Historic Preservation requirements.



## Transparent Earth Collaboration Meeting

On June 7-8, the Transparent Earth Collaboration met at the University of California, Berkeley. The meeting was well attended and collaborators made substantial progress on budget requirements, schedules, and experiment requirements. A review of the currently envisioned facility footprint was made and was found to compare favorably with the needs of the collaboration at this stage. Experiments discussed at the meeting ranged from the installation of three-dimensional seismic and electromagnetic arrays to microgravity and high-sensitivity magnetic instrumentation.

Representatives from the Fracture Processes Collaboration also attended the meeting and presented their plans for dedicated laboratories in the underground. Cooperation between Fracture Processes and Transparent Earth was discussed with regard to how geophysics could assist with the experiment goals of the Fracture group.

## Focus on: Microbes

We have all been taught in high school or our freshman year in college that multi-cellular organisms require O<sub>2</sub> to live. In fact, the fossil record suggests that multi-cellular animals did not evolve until the Neoprotozoic Era, ca. 700-800 Ma, after O<sub>2</sub> levels in the atmosphere had risen to levels comparable to present day concentrations.

But wait a minute! In a recent issue of *BMC Biology*, Italian scientists reported finding small, living, multi-cellular animals, metazoans, in sea floor sediment at the bottom of the deep, >3 km, anoxic, hypersaline, H<sub>2</sub>S-rich, L'Atalante basin in the Mediterranean. The tiny, ~100 microns in size, meiofauna, belonged to the phylum Loricifera (accent on third syllable), did not possess mitochondria and contained a large number of hydrogenosome-like organelles associated with endosymbiotic archaea. Single-cell Eukaryotes, i.e. protists, found living in anoxic environments also lack mitochondria and possess the same hydrogenosome-like organelles.

This is the first reported occurrence in multi-cellular animals, which raises obvious questions about when multi-cellular animals first evolved from single-cell Eukaryotes, what role do the Prokaryote endosymbionts play in their metabolism, how do they reproduce and just how complex can life become in anoxic conditions.

One final question that DUSEL could answer is whether similar multi-cellular animals exist beneath the Earth's surface in fractures that are large enough to house them. The steeply dipping Homestake formation combined with the wide expanse of the Homestake mine tunnels enable geomicrobiologists to access fractures through drilling from depths ranging from 100 meters where fracture widths could easily accommodate multi-cellular animals to 2500 meters where fracture widths might be too small. For a larger photographic image, click on: [Loricifera](#).



## DEDC to DuRA Transition

The vote for the election of members to the DuRA executive committee opened Monday, May 24 and closed Friday, June 11, 2010. The DEDC thanks all who were willing to stand for this important office as representatives of the subsurface science community.

About 200 votes were cast for the available seats. Congratulations and thanks to the following who will take office either July 1, 2010 or Jan 1, 2011.

July 1, 2010 (alphabetical order)  
Prisca Cushman  
Steve Elliott  
Rick Gaitskell  
Duane Moser

January 1, 2011 (alphabetical order)  
Manoel Couder  
Andrew Hime  
Ken Lande  
Joe Wang



## DUSEL IN THE NEWS

### To read about DUSEL stories:

Tunneling for fractals: “Geophysicists have observed fractal patterns around active faults. However, more data, especially at varying depths, are needed to connect observed random ground motion to [Vladimir] Shiltsev’s large-scale fractal patterns in the Earth. To collect such data, Shiltsev and Fermilab colleague Jim Volk are installing sensors in tunnels in the Deep Underground Science and Engineering Lab (DUSEL), which is being built 2 km below ground in South Dakota’s Homestake mine. DUSEL, which will be used for neutrino research and other experiments, should be operational by 2014.”

To read more, click here: [Physicsworld.com](http://Physicsworld.com)

<http://www.duselwatch.com/> - Wendy Pitlick  
June 22: Cultural outreach; *DUSEL excavation; Major scientific discovery in Italy; Lab crews making strides in pump installation; Rounds says Italian lab looking forward to DUSEL development*

*Opportunity knocks at Homestake* – Dennis Gale  
<http://www.argusleader.com>– June 13

[www.sanfordlab.org/](http://www.sanfordlab.org/) - Check out “Twitter updates” in lower left hand column

## SANFORD UNDERGROUND LABORATORY AT HOMESTAKE

### LUX Surface Lab

During the week of June 14, the LUX dark matter detector team met at the LUX Surface Lab. The group included researchers from Case Western Reserve, UC Davis, Brown University, Texas A&M and Yale University. They assembled containment vessels, electronics, cables, conduits and a gas purification system.

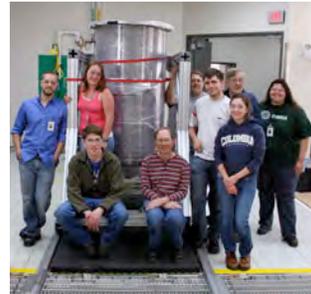


Figure 5: Movers shown with cryostat cylinder. Left to right: Grad students David Malling (Brown); Ty Stiegler (Texas A&M); Nick Walsh, (UC Davis); Research Associate Mike Dragowski, (CWRU); SDSTA Techs Gary Larson, Mike Dopulich; Grad students Michael Woods (UC Davis); Rachel Mannino (Texas A&M); Surface Lab Supervisor Connie Giroux

According to Dan Akerib, the cylinder, which is the outer vessel of a two-cryostat system, was shipped upside down because that was easier. Once it arrived, it had to be righted by the LUX team.



Figure 6: During the move

The system will contain liquid xenon crucial to the LUX experiment. The inner cryostat, a titanium pressure vessel, holds the xenon. The outer cryostat maintains a vacuum between the inner pressure vessel and the outer water tank, which will be used to protect the entire LUX detector.

### Cavern Update

Progress continues at the 4850 Level. A central column has been removed from the Transition Cavern (130 feet long and 50 feet wide) that will serve the LUX and Majorana experiments. The Majorana clean room space is nearly ready for occupancy.



Figure 7: Majorana

room with finished concrete floor

At the Davis Cavern, rock is still being removed. When this process is finished, the cavern will be nearly 40 feet high.

## EDUCATION AND OUTREACH

### Early Education Activities

**Public Outreach:** On June 1, in Lead and June 2 in Rapid City, Sanford Lab and DUSEL hosted public open houses to update the community on progress towards DUSEL. Sanford Lab and DUSEL team members manned tables concerning different project components ranging from engineering design and operations to science, education, and cultural outreach. The Lead workshop, held at the Golden Hills Resort, attracted approximately 50 community members, most of whom came early and stayed the full two hours. The Rapid City meeting, held at SDSMT, attracted about 35 community members and students.



Figure 8: DUSEL Project

Engineer Wendy Zawada talks about engineering design with community members in Lead

**K-12 Education:** The 2010 SD GEAR UP Honors Program is back on the SDSMT campus for the 18<sup>th</sup> consecutive summer. The purpose of this six-week residential program is to prepare Native American students in grades 9-12 to be successful in the college setting. Much of the funding for the program comes from a federal GEAR UP grant through the State of South Dakota Department of Education. It is operated through Oceti Sakowin Education Consortium and 24 partner schools.

This year, Sanford Underground Laboratory is partnering to provide content for the students at three grade levels. The effort has been organized by Connie Giroux, a member of the Science Department, an enrolled member of the Rosebud tribe, and an alumna of both SDSMT and SKILL, a precursor program to GEAR UP.

During the week of June 14-18, Peggy Norris, SDSMT graduate student Mark Hanhardt and undergraduate interns Haaken Phelps and Ginny Price worked with 31 seniors. Lectures were presented on the birth and death of stars and on radiation. Activities included natural radioactivity, properties of radioactive decay, half-life and cloud chambers. The week culminated with a tour of the LUX surface laboratory and the Yates hoist room. LUX graduate students David Malling (Brown University) and Michael Woods (UC Davis) gave presentations to the students.



Figure 9: Nick Walsh, a

graduate student from University of California at Davis, explains the LUX experiment to an aspiring physicist

Over the next few weeks, Connie Giroux, John Scheetz and Julie Dahl (BHSU) are organizing activities and lectures for the freshmen and junior students as well. One hundred and thirty freshmen are scheduled to tour the Waste Water Treatment Plant on June 25.

**Undergraduates:** On June 5, the 2010 Davis-Bahcall Scholars and Homestake-Fermilab Summer Scholars programs kicked-off with a one day meeting at the Capitol University Center in Pierre, SD. Students and parents had the opportunity to meet program organizers and chaperones, listen to a talk about DUSEL science, and enjoy lunch, courtesy of the Governor's Office. In the afternoon, students competed individually and in teams in a Physics Olympics.



*Figure 10: Ginny Price, Nicole Dejong, Bryce Frentz and Dexter May show off their engineering skills, attempting to lift the most weight the highest distance using a hair dryer*

The ten 2010 Davis-Bahcall Scholars will be at Sanford Lab from June 28 to July 2. Lectures and activities in nuclear, particle and astrophysics are planned, as well as enrichment lectures from members of several early science and DUSEL S-4 collaborations. The students will travel to Europe from July 11-17 to visit CERN and Gran Sasso, then return to Princeton for three weeks of study organized by Frank Calaprice and his group. The 2010 Davis-Bahcall Scholars are college sophomores Nicole Dejong (Black Hills State), Jerry Farke (SDSMT), Nathan Harding (University of South Dakota), and Ginny Price (Montana State), and entering college freshmen Bailey Breems, Bryce Frentz, Andrew Gaspar, Louis Kjerstad, Dexter May, and Stephanie Vedvei. The students will be accompanied by a student chaperone, 2009 Davis-Bahcall Scholar Karin Hanson (South Dakota State), who is interning at Princeton this summer, and Sioux Falls O’Gorman High School physics teacher, Jane Schnell. On the European leg, the students will also be accompanied by physicist Barbara Sczcerbinska (Dakota State).

### Diversity Summit

The annual All-Investigators Meeting for the South Dakota NSF EPSCoR Research Infrastructure Improvement grant took place on June 14-15 in Chamberlain, SD, and this year, for the very first time, it included a statewide Diversity Summit, organized by DUSEL Education Director Ben Saylor. The Diversity Summit brought together investigators and diversity professionals from the various partners on the EPSCoR grant to highlight programs and discuss issues related to recruitment and retention of women and American Indians in Science, Technology, Education and Mathematics disciplines at all levels from K-12 through post-graduate study and within professions.

### ENVIRONMENT, HEALTH & SAFETY

Cultural and Diversity Liaison and Coordinator George Campbell is planning a gradual transition away from DUSEL Project activities over the next few months. George came to the Project after a long and distinguished career at Lawrence Livermore National Laboratory and within the UC system. The Project has benefited greatly from his advice and extensive experience dealing with scientific research laboratories. In particular, he has helped in the areas of developing the safety oversight program and the program associated with cultural and community issues. He formed the Cultural Advisory Committee, and also provided it with direction, ensuring that it is a vibrant body contributing significantly to the development of the Project and well integrated with the Sanford Lab efforts. Many thanks to George as we move into the next phases of the project, and we wish him well. We will continue to welcome his input and advice in the future.



### Places to visit in or near Lead, SD

Homestake Visitor Center-160 West Main St, Lead  
 Stampmill Restaurant-305 W Main St, Lead  
 Chubby Chipmunk-420 Cliff Street, Deadwood  
 Adams Museum & House, Deadwood  
 Mt Rushmore National Monument  
 Crazy Horse Memorial

### Summer Reading about South Dakota

*The Black Hills Illustrated*, George P. Baldwin, Republished from 1904  
*Going Over East: Reflections of a woman rancher*, Linda Hasselstrom  
*The taking of Libbie, SD*, David Housewright – Mystery/Detective  
*The work of wolves*, Kent Meyers (Suspense fiction by BHSU English Prof)  
*Gold in the Black Hills; Black Hills Ghost Towns* – two books by Watson Parker  
*Black Hills*, Nora Roberts – Romance-Suspense  
*Black Hills*, Dan Simmons – Sci-fi fantasy

# HOMESTAKE DUSEL AND SANFORD LABORATORY NEWSLETTER

## NEW STAFF



**Dale Barker** started in mid-June with the SDSTA in support of DUSEL. He will serve as a DUSEL Project Controls Engineer and will be located in Lead. Dale will provide the main interface between the South Dakota-based DUSEL project management and engineering staff and the Berkeley Project Controls Team. As DUSEL works to prepare its cost and schedule baseline for DUSEL construction for the preliminary design review this fall, Dale will be a welcome addition and will help greatly in successfully completing the PDR. Dale has over 30 years of experience in project management and scheduling and has worked for the past 15 years fixing troubled projects for ExxonMobil.

Dale is a native of South Dakota. His family lives in Belle Fourche and he is very excited to be a part of the DUSEL team.



**Jean Souza**, the DUSEL Systems Engineering and Integration Lead, comes to the program with 20+ years experience in the commercial and civil satellite industry in project management, system engineering and mechanical engineering. Her engineering experience includes design trade-offs, design implementation, structural analysis, shock, mechanical alignment, testing, fracture mechanics, and materials. She is an expert in the systems engineering process from definition, development, manufacture, integration and verification. Jean was looking for a challenging career opportunity when she joined the DUSEL program.

Her husband Gregg, 10-year old son Ian, their Australian Cattle Dog, Jakkhi, and three birds just relocated to Berkeley from Durango, CO. Ian loves to play Legos, build marble mazes, Rube Goldberg machines, and would love to meet kids his age with

similar interests. Gregg is looking forward to exploring the East Bay on his Bianchi road bike. Jean is looking forward to visiting old friends on the Peninsula and the South Bay.

Jean's favorite quote: *Our patience will achieve more than our force.* - Edmund Burke

## UPCOMING EVENTS AND ANNOUNCEMENTS



**Neutrino Weekend 2010 - A Science Adventure!** Neutrino weekend will start Friday, July 9 at 7 pm. A free science festival for students of all ages will take place on Saturday, July 10, in Lead at the Sanford Underground Science and Engineering Laboratory at Homestake. Join the Sanford Underground Laboratory staff and partners, including the Lead Chamber of Commerce and South Dakota Public Broadcasting, for a Saturday morning of science fun. Catch the free shuttle bus at the Homestake Visitor Center at the Open Cut in Lead. Activities include:

- \* Hands-on science activities
- \* Exhibits
- \* Science lectures for general audiences. (9 a.m., 10 a.m., 11 a.m. and noon)
- \* Q&A's with scientists. (After the science talks.)
- \* Walking tours of the Yates Shaft hoist room. (All morning. Wear sturdy shoes.)
- \* Videos
- \* Coordinated with a Science-and-the-Arts festival in Lead, July 10-11, including Dick Termes lecture at 309 Main Street, July 11 at 1 p.m.
- \* SD Public Broadcasting's "Science Cafe" will be at 7 p.m., Friday, July 9, at the Stampmill on Main Street in Lead.

For more information:  
Bill Harlan - [bharlan@sanfordlab.org](mailto:bharlan@sanfordlab.org)

**Calling on DUSEL Science groups in the Washington, DC area: The Inaugural USA Science & Engineering Festival**, the country's first national science festival, will descend on the Washington, D.C. area in October 2010. The Festival promises to be the ultimate multi-cultural,

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multi-generational and multi-disciplinary celebration of science in the United States. The culmination of the Festival will be a two-day Expo in the nation's capital that will give over 500 science & engineering organizations from all over the United States the opportunity to present themselves with a hands-on, fun science activity to inspire the next generation of scientists and engineers.

For more information: [usasciencefestival.org](http://usasciencefestival.org)

DUSEL/Sanford Lab will have a tent at the Expo in the Mall on Saturday and Sunday, October 23-24. We will have several hands-on activities set up, and need some enthusiastic and energetic volunteers. If you live close to the DC area, please consider sending some of your postdocs and graduate students to volunteer for a few hours in the DUSEL tent, or even participating yourself. Contact Peggy ([pnorris@sanfordlab.org](mailto:pnorris@sanfordlab.org)) for more details.

**Be a Project Leader - Make a difference in science and math education** at the Summer Math and Science Honors (SMASH) Academy.

Session 1: June 29-July 13

Session 2: July 15-July 29

Since 2004, the Berkeley Experimental Cosmology group has partnered with the Level Playing Field Institute (LPFI) to support the Summer Math & Science Honors (SMASH) Academy, by presenting Topics in Current Science Research, a 5-week course for SMASH students who have just completed 9<sup>th</sup> grade.

For additional information:

[cdms.berkeley.edu/UCBlabs/Main/SMASH](http://cdms.berkeley.edu/UCBlabs/Main/SMASH)

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Rachel Winheld \* [winheld@berkeley.edu](mailto:winheld@berkeley.edu)

**Fourth Pontecorvo School** - The IV International Pontecorvo Neutrino Physics School," organized by JINR (Dubna) will be held 26 Sep - 6 Oct 2010 in Alushta (Crimea, Ukraine). For more info: <http://pontecorvosch.jinr.ru/>



## JOBS

Postdoctoral Position in Experimental Dark Matter Physics. Southern Methodist University. Contact

Jodi Cooley, [cooley@physics.smu.edu](mailto:cooley@physics.smu.edu). For more details:

[http://www.physics.smu.edu/web/jobs/supercdms\\_postdoc.html](http://www.physics.smu.edu/web/jobs/supercdms_postdoc.html)

Postdoc Research position in neutrino physics, Physics Dept, Stanford. Contact Ms. Marcia Keating, Varian Physics, Stanford, CA 94305-4060; email: [mkeating@stanford.edu](mailto:mkeating@stanford.edu).

**Newsletter Editor:** Melissa Barclay

**Contributors:** Kevin Lesko, Bill Harlan, Dale Barker, Derek Elsworth (DuRA), Bob Kaufman (Historic Preservation), Tullis Onstott (Microbes), Peggy Norris and Ben Saylor (Education and Outreach), William Roggenthen (Transparent Earth), and Jean Souza.

**Photo Credits:** Fig. 1: Kathi Mueller; Fig. 2: LNGS; Figs. 3-4: Homestake Adams Research and Cultural Center; Figs. 5,6,8,9: Bill Harlan; Fig. 7: Steve Babbitt, BHSU; Fig. 10: Barbara Sczcerbinska, Dakota State University.

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