

HOMESTAKE DUSEL AND SANFORD LABORATORY NEWSLETTER

Dear Homestake Collaboration,

Welcome to the August 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

September 2: Abstracts due for special session on research at underground labs at the Fall AGU meeting

September 2-3: First Annual DuRA Users Meeting - Fermilab, Batavia, Illinois - (More details on page 5)

September 14-15 - NSF Site Visit – UC Berkeley

October 18-20: Annual Internal Review - Berkeley

primary steward of each major experimental program or system within the DUSEL project.

We are impressed by the breadth and depth of the DUSEL science. The envisioned program in physics and astrophysics will address fundamental questions about the Universe and its fundamental laws, such as the question of why the universe contains matter but no antimatter, the nature of dark matter, the origin of neutrino mass, and the genesis of the chemical elements. The biology program will study life in extreme conditions underground to shed light on the origin and evolution of life. The geosciences program will have opportunities to study directly at depth variety of the thermal, hydrologic, mechanical, chemical, biological-mass, and energy-transport phenomena on a scale not done before. The engineering program will study rock properties *in situ* to enable better design and use of underground space. In addition, the Committee felt that the interdisciplinary laboratory, with sustained support, will provide unique scientific opportunities that engage and educate the next generation of scientists and engineers.



DUSEL IN THE NEWS

PAC Meeting Summary

The DUSEL Program Advisory Committee met for the first time on July 27 and 28, 2010 in Berkeley. The Committee heard presentations on the progress towards the Preliminary Design Report to be submitted to the National Science Board. We thank Kevin Lesko, the Principal Investigator for the DUSEL project, and his team for informative presentations on the tasks that have been accomplished and those that are in progress. The Preliminary Design Report is due by the end of the year. We find that the overall progress has been excellent. It will be the basis for an MREFC proposal to start construction of the DUSEL facilities in FY2014. The proposal will include a suite of experiments to be built using a "stewardship" model that details how the responsibilities will be shared by the National Science Foundation and the Department of Energy's Office of Science. In this model, one of the two agencies is assigned as the

To read about DUSEL stories:

SDPB.sd.gov/: *"Innovation"* radio show host Cara Hetland interviews Connie Giroux, Jaret Heise, Bill Roggenthen and Wendy Zawada during a recent visit to Sanford Lab.. Aired on 7/23/10. Archived version: <http://bit.ly/PublicRadSanLab>

Black Hills Pioneer: *S.D. students discover new world of science at Fermilab* - August 6 (by Wendy Pitlick)

Northern Valley Beacon: *Caterpillar crawls into the Hills* - <http://newqstudio.blogspot.com/> - August 4 (with David Newquist)

www.sanfordlab.org/ - Check out "Twitter updates" in lower left hand column

SANFORD UNDERGROUND LABORATORY AT HOMESTAKE

Construction Updates



Figure 1: Undergruond Construction Project Engineer Wendy Zawada (in yellow jacket) in large Davis Cavern

Davis Cavern

By the last week of July, Sanford Lab crews had removed 13,000 tons of rock to enlarge the Davis Cavern. The crew of 11 includes nine former Homestake miners working 10-hour shifts a day. The rock is disposed of about two miles away, in old, deserted stopes and drifts on the 500 level.

Once the muck is removed from the Davis Cavern, rock bolts will be installed in the lower walls. Excavation and mucking continues in the Transition Cavern, with an expected work completion date of early to mid-September.

The next excavation will be at the large cutout at the 4850 Level near the Yates Shaft - 25 feet wide by 12.5 feet tall by 142 feet long.



Figure 2: C-TEC and Sanford Lab personnel apply shotcrete on 4850 Level

At the end of July, C-TEC, a company based in York, Nebraska, completed shotcreting of the former Homestake electrical shop, a cavern at the 4850' level which will eventually be the copper electroforming laboratory for the Majorana Demonstrator neutrinoless double-beta decay experiment.

The process took about five days, resulting in a three-inch layer of shotcrete, a spray-on type of concrete used to protect the rock's surface. A modular clean room will be installed in the cavern, enclosed by the shotcreted walls. Sanford Lab technicians and staff also worked on the project.



Figure 3: Infrastructure techs cut old pipe out of the Ross Shaft under wet conditions

Pipe removal in the Ross Shaft began in early June and was completed July 24. Infrastructure Tech Rodney Hanson worked with 17 Sanford Lab technicians and engineers on this project.

Over a 50-year period, several varieties of old pipe had been installed by the Homestake Mining Co. Crews cut pipes out of the Ross Shaft using cutting torches and a chain hoist to free sections of pipe. Since water was diverted down the Ross to keep the shaft guides lubricated, and water flowed above the 3800' level drain into the shaft, the result created a very damp working environment.

Now the Ross is ready for the next phase. A new pump column will be installed from the pump room at the 5000 Level to the 3650 Level. Underground Op's Foreman Jack Stratton expects the new pump column to be completed later in August.

The water level at the Sanford Underground Laboratory has remained stable in 2010 -- between 5050 ft and 5084 ft underground -- while preparations for two major upgrades are in progress. The first upgrade will be the installation of a deep-water submersible-pump system that will be lowered down #6 Winze to just below the 7400 Level. Two submersible pumps, in tandem on one pump column, will lift water to the 5000' level. The second upgrade will restore the permanent pump room at the 5000 Level. This is the same pump room used by Homestake Mining Co. Two 700-horsepower pumps will lift water to the pump room at the 3650 level. The 5000 level pumps will replace a series of smaller submersible pumps used during the first

phase of dewatering. The start-up of the new system is expected in the summer of 2010.

U.S. Geological Survey (USGS) Research



Figure 4: Left: USGS Research Hydrologist Andy Long checks gravimeter as it measures microgravity in the Ross Shaft yard. Map at right indicates measurement stations at or near Sanford Lab

During the dewatering process, USGS research hydrologists have been measuring microgravity at the site. Using a gravimeter, USGS Research Hydrologist Andy Long and his colleagues from the USGS South Dakota Water Science Center took their first measurements at 17 locations at or surrounding Sanford Lab in 2007. This July, they returned to many of the same locations for additional measurements. Their goal is to explore how dewatering the Sanford Lab affects the deepest groundwater in the area, a field of potential discovery about which little is known.

The ultrasensitive gravimeter measures changes in the earth's gravity that can result as water moves out of the cracks and fissures in deep rocks, leaving voids and lowering the total mass of rock. The changes are so minute that they can be almost imperceptible. In addition, precipitation adds water to shallow aquifers and increases soil moisture, which in turn affects microgravity. Although there is groundwater throughout the earth's crust, the rock deep underground at Homestake is not very permeable. The force of gravity is measured in a unit of acceleration known as a Gal, sometimes called Galileo for Galileo Galilei, who made the first measurements of the Earth's gravity. The unit is used extensively in the science of gravimetry. The USGS gravimeter measures microgals – millionths of a gal. The scientists may take a measurement every year for several years before drawing any conclusions.

EDUCATION AND OUTREACH

Planning for the Sanford Center for Science Education (SCSE)

David Heil and Associates (DHA) – the firm that performed the initial market analysis for the SCSE last winter – has been re-engaged to conduct intercept-interviews of tourists before the summer tourist season ends. On July 29, the firm conducted a training session for local field researchers to survey tourists at regional attractions such as Mount Rushmore and Deadwood to obtain data about potential interest in visiting the SCSE at DUSEL. The interviews began July 30 and will continue into the shoulder season in September. The work is funded in part by the South Dakota Department of Tourism; an initial report will be ready in time to inform the Preliminary Design document for DUSEL construction.

Early Education Activities

K-12 Education. During July 18 - 21 teachers from around northeastern South Dakota attended a special-topics graduate course at Northern State University on atomic and nuclear physics, inspired by the desire to introduce topics related to DUSEL into the curriculum in their middle and high school courses. Peggy Norris was the primary instructor for the course, with some lectures given by Judy Vondruska (SDSU) and Tina Keller (USD). The course, which was funded by the South Dakota NSF EPSCoR RII grant, will continue throughout the school year with monthly online sessions on the topics of particle and astrophysics related to DUSEL research.



Figure 5: Physics of Atomic Nuclei, Northern State University, Aberdeen, SD, July 18-23, 2010. Participants from schools in Aberdeen, Chamberlain, Dell Rapids, Groton, Hayti, Highmore, Lennox, Leola, Mellette, Mitchell, Sioux Falls, Tripp, Watertown, and Webster

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Undergraduate Activities

On July 23, ten Homestake-Fermilab summer scholars returned for a week of activities at Sanford Lab after spending two weeks at Fermilab. While at Fermilab, the students built two Quarkne-style cosmic ray detector arrays which are now at Sanford Laboratory to be used in educational programs. They also participated in tours and lectures concerning the topics of neutrinos, astrophysics, and superconducting magnets. Because of the ongoing renovation of the Yates Dry, Sanford Lab activities were held in the classroom at the Homestake Opera House. Students attended lectures by Steve Elliot (Los Alamos), Steve Gabriel (Spearfish High School), Jaret Heise (SDSTA), Warren Matthews (DUSEL), and Peggy Norris (BHSU). In addition, they toured the LUX Surface Laboratory with graduate student Nick Walsh (University of California at Davis), the Homestake Mining Museum, the DNA laboratory at BHSU with Cynthia Anderson (BHSU) and participated in a geology tour of the northern hills with Larry Stetler (SDSMT).



Figure 6: Homestake-Fermilab scholars in the atrium at Fermilab. Back row, from left: Steve Shaefer (Rapid City), Carlos Beatty (Douglas), Cody Marnach (Sioux Falls), Casey Janisch (Clark), Alex Reid (Spearfish), Erica Drealan (Fulda, MN). Sitting: Kariah Kurtenbach (Brookings), Amber Kruse (Scotland), Haaken Phelps, student chaperone (Lake Preston), Erika Zetterlund (St. Cloud, Mn). Kneeling: Adam Caldwell (Lead), Steve Gabriel, teacher chaperone (Spearfish)

On August 5, the Davis-Bahcall fellowship students – having toured CERN and Gran Sasso in Europe followed by a physics course at Princeton University for three weeks – finished their summer experience by entertaining Governor Rounds and some of his staff with a dessert party at Princeton. The Governor came to attend the closing ceremony for the 2010 Princeton-Gran Sasso-South Dakota summer school.



Figure 7: Davis-Bahcall students with Professor Neta Bahcall and Governor Rounds at Princeton. From left: Jerry Farke (Armour), Andrew Gaspar (Sioux Falls), Louis Kjerstad (Rapid City), Dexter May (Brookings), Stephanie Vedvei (Groton), Neta Bacall, Nate Harding (Jefferson), Nicole Dejong (Avon), Bailey Breems (Sioux Falls), Bryce (Sioux Falls), Governor Rounds, Ginny Price (Rapid City)

The Education and Outreach Department thanks everyone who contributed to the flurry of summer programs from Sanford Lab, DUSEL, the local universities, the community, and the science collaborations. See Figure 8 for the total numerical impact of all summer programs.

Figure 8

Audience	Number
Educators (K-12)	29
Students (K-12) – total/under-represented	250/230
Students (Undergraduate)	30
Students (Graduate)*	5
General Public*	550
Total Summer 2010 (all sectors)	864

* Students participating in education or outreach events as presenters

** Includes students and educators attending Neutrino Day

ENVIRONMENT, HEALTH & SAFETY



Summer Safety

Keep hydrated. Drink non-alcoholic or non-caffeinated beverages.

If you decide to drink an alcoholic or caffeinated beverage, be sure to also drink plenty of water.

Don't drink alcohol and drive. This includes "driving" a boat or other water vehicle. Alcohol is a leading contributor in boating deaths and injuries.

LBLN Safety: Ergonomics message from Marty White

- Take Remedy Interactive self-assessment:
(<http://www.lbl.gov/ehs/training/webcourses/EHS0059/>)

- If you experience discomfort, request an ergonomic evaluation:

<https://ehswprod.lbl.gov/Ergo/Login.asp?p=RequestEvaluation.asp>

New Safety pages on Sanford Lab website:
www.sanfordlab.org - Use the left hand menu to open individual pages

UPCOMING EVENTS AND ANNOUNCEMENTS

First Annual DuRA Meeting

Dates: Thursday, September 2: 1-5 pm
Friday, September 3: 8:30 -5 pm

Location: Fermilab - Batavia, Illinois

This meeting will be of interest to the broader scientific, education and engineering communities involved in planning research and activities at DUSEL. It will be the first of what we expect will be many annual meetings organized by the newly formed DUSEL Research Association.

The meeting will feature:

1. Preliminary Design Synopsis: The Facility team will present a synopsis of the DUSEL Preliminary Design and plans and schedule for presenting the design to the NSF this year.

2. Science Integration in Preliminary Design:

The Facility team will describe the generic experiments that have been integrated into the facility design.

3. Community-Facility Interaction: An open dialogue between the science community and the Facility team will be held to discuss aspects of the upcoming PDR and other DUSEL-related issues.

4. DUSEL Science: Representatives from the physics, earth science, and engineering communities will review the state-of-the-science and needs of their community, particularly with respect to DUSEL. The mission and purpose of DuRA will be presented and new members of the Executive Committee will be introduced. The newly formed DUSEL Program Advisory Committee will be also be described and introduced.

5. Agency Perspectives: Representatives from NSF and DOE will present their perspectives on DUSEL science program.

Please register in advance at:

<http://www.dusel.org/workshops/fallworkshop10/index.htm>

Other DuRA Events

DuRA presentations will also take place at the following upcoming meetings. Some highlights will be presented by the speakers in future monthly reports:

NSF BGE S-4 Program Review, August 24-26, 2010, Washington, D.C.

Workshop for Future Directions in Geobiology and Low-Temperature Geochemistry, August 27-28, 2010, Carnegie Institute
<http://www.geochemsoc.org/news/announcements/workshopfuturedirectionsin.htm>

International Conference on Greenhouse Gas Technologies, September 19-23, 2010, Amsterdam
<http://www.ghgt.info/>

Neutrino Geoscience 2010, October 6-8, 2010 Gran Sasso
<http://geoscience.lngs.infn.it/>

ISRM International Symposium 2010 and 6th Asian Rock Mechanics Symposium October 23-27, 2010, New Delhi
<http://www.arms2010.org/>

2010 AGU Fall Meeting, December 13-17, 2010,
San Francisco - Sessions H52, NH13 - (Abstracts
due on September 2, 2010)

There will be a special session on research at underground labs, particularly at DUSEL, at the Fall Meeting of the American Geophysical Union (AGU), December 14-18, 2010 in San Francisco. The session is listed as H52, Rocks, Fractures, Fluids and Life, Insights from Underground Research Laboratories. The session description is:

Underground laboratories play an important role in research into earth processes by providing access to a broad range of geologic, hydrologic, and microbiologic settings. The purpose of this session is to present results from previous and ongoing experiments at underground research laboratories and deep boreholes worldwide, as well as conceptual designs for an initial suite of experiments at DUSEL. We particularly encourage papers that describe new results, proposed experiments, or innovative technologies in hydrology, geophysics, geochemistry, isotope geochemistry, particle physics, astrophysics, microbiology, rock mechanics and engineering, petrology, radiation biology, and related fields.

For more information:

<http://www.agu.org/meetings/fm10/>

Please send information to Derek Elsworth (elsworth@psu.edu) for upcoming meetings with known presentations from DuRA members, and any other initiatives or ideas.

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, 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

DUSEL/Sanford Lab will have a tent at the Expo on 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) for more details.

The next Assay and Acquisition of Radiopure Material (AARM) collaboration meeting will be held at Sanford Lab in South Dakota on Friday-Saturday: November 12-13. Homestake Tours and informal meetings will take place on Thursday afternoon before the meeting.

Over the last year we have gone through the exercise of designing a common use low background counting facility (FAARM) for DUSEL. Such a facility will not be up and running until 2018. The focus of this collaboration meeting is to plan early implementation of screening, assay, material stockpiling, etc. for the period leading up to DUSEL and how to make a smooth transition. We will therefore be asking each current and future experiment and all ISE's to send an official representative to the meeting. We have an opportunity to form a unified plan for early screening and seek resources to make it happen. This will involve multiple sites and existing assay installations as well as building up strength in this field. The facility plans themselves will also be reviewed and critical comments are welcome.

Advances in Neutrino Technology 2010, Santa Fe, September 16-18: The Advances in Neutrino Technology series of workshops are unique in format and philosophy. The vision of the workshop is to have extended discussions of technical issues at a level would normally find only in a collaboration meeting. In ANT workshops, we can share ideas across the boundaries of different experiments in order to advance our whole field and improve the quality and sensitivity of neutrino experiments in general. Not all ideas presented have to be "fully-baked" in all details. You will have the opportunity to hear what others are working on in addition to getting expert feedback on your own ideas in "real time".

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For more information and to register, please visit the web site at: <http://www.physics.ucdavis.edu/ANT10>

This workshop is partially supported by the National Science Foundation and includes a number of awards to support local expenses for graduate students who wish to attend all three days. Please contact the conference organizers at: vmg@lanl.gov for an application.

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



JOBS

Postdoctoral positions in the McKinsey group at Yale, Dept. of Physics. Research possibilities include development of LXe, LAr, and LNe as materials for particle detection, as well as their use in the LUX and MiniCLEAN dark matter experiments. Especially experienced candidates may be considered for a research scientist position. Send CV, statement of research interests, and list of publications to: Daphne Klemme, Dept. of Physics, Yale University, PO Box 208120, New Haven, CT 06520-8120 or daphne.klemme@yale.edu.

Postdoctoral Position In Particle Detector Development, Dept. of Physics, UC Santa Barbara. Lead detector R&D program aimed at building ultra-high-resolution particle detectors for future neutrino and dark matter detectors, assist in hardware and analysis work on KATRIN neutrino experiment. Project may involve work in UCSB Nanofabrication Facility (<http://www.nanotech.ucsb.edu/>). Available Nov. 1, 2010 (neg). Include current CV, statement of research interests; arrange three letters of reference. Contact: Professor Ben Monreal, bmonreal@physics.ucsb.edu.

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