Dear Homestake Collaboration,

Welcome to the October monthly newsletter for Homestake DUSEL and South Dakota's Sanford Laboratory. We are always glad to receive your input on news, links to news articles, upcoming workshops, conference notices, scientific updates, information concerning the Collaboration, and other highlights relevant to our shared goal.

Important Dates

December 7-11: Red Team – Berkeley

January 2010: Draft Experiment Development Plans Due to the Project Office

February 9-11, 2010: Annual DUSEL Review - Berkeley

PRESS RELEASE FROM UC BERKELEY

NSF authorizes $29 million for world's deepest underground lab

By Robert Sanders, Media Relations | 15 October 2009

BERKELEY — The National Science Foundation (NSF) has authorized more than $29 million for the University of California, Berkeley, to create a preliminary plan for turning a former gold mine in South Dakota into the world's deepest laboratory.

The grant, approved Sept. 24 by the National Science Board, is for a preliminary design of the Deep Underground Science and Engineering Laboratory (DUSEL), a facility at the former Homestake gold mine in Lead, S.D. The laboratory would consist of underground labs and above-ground buildings to host physics, engineering, geoscience and biology experiments that can only be conducted under thousands of feet of rock, as deep as 8,000 feet.

The rock would shield physics experiments from cosmic ray particles that would swamp detectors looking for rare events, while the mine's 600 kilometers of tunnels would allow access to microbes and geological areas not otherwise possible.

Figure 1: Diamond-drill core samples, taken 4850 feet underground in the former Homestake gold mine, will tell geologists and engineers where best to excavate drifts and caverns for the Sanford Underground Laboratory. (Bill Harlan/SDSTA)

The rock would shield physics experiments from cosmic ray particles that would swamp detectors looking for rare events, while the mine's 600 kilometers of tunnels would allow access to microbes and geological areas not otherwise possible.

"NSF has put forward nearly $30 million and, in addition, provided $21 million more to explore 16 possible experiments, so they are embracing DUSEL very firmly," said Kevin Lesko, UC Berkeley adjunct professor of physics and principal investigator for the project.

Of the $29.1 million, nearly $13 million will be directed to the South Dakota School of Mines and Technology for major design contracts being managed there for the project and $370,000 to Lawrence Berkeley National Laboratory. The preliminary design for the underground laboratory would be part of a proposal submitted to the board in the spring of 2011 in anticipation of funds to start construction in fiscal year 2013.

Figure 2: Workers drill a core to take stress-measurements in order to evaluate the quality of the rock for construction of very large caverns. The caverns will be part of the Sanford Lab and will continue to house DUSEL experiments. (Steve Babbitt, Black Hills State University/ SDSTA)

Construction is already underway at the mine after

the June dedication of the Sanford Underground Science and Engineering Laboratory, which is supported by $70 million from South Dakota banker and philanthropist T. Denny Sanford. In all, more than $120 million of non-NSF funding has been committed to rehabilitating the shafts and pumping and treating water from flooded depths to prepare the site for DUSEL.

The Sanford Lab, located at a depth of 4,850 feet, will house the first experiments: the Large Underground Xenon (LUX) experiment, which will look for dark matter; and the Majorana Demonstrator, which will search for neutrinoless double beta decay. If the NSF approves construction funds, DUSEL is expected to absorb and maintain the Sanford Lab as additional research space is prepared at the 4,850-foot and 7,400-foot levels.

"We are pursuing some of the most exciting aspects of several different disciplines simultaneously; not just experiments on dark matter, but experiments on neutrinos and in the areas of nuclear astrophysics and geomicrobiology, all in one facility," Lesko said. "We will exploit the synergies between those different disciplines."

In 2007, when the NSF selected the Homestake site for a national deep underground lab, the agency also chose the UC Berkeley team to develop key elements of the preliminary design and refine the lab's proposed scientific, educational and engineering goals. The campus submitted in May of 2009 a proposal to complete the preliminary design of research areas in chambers at the 7,400-foot and 4,850-foot levels, as well as to support space on the surface. Working with Lesko are Project Director Kem Robinson and Co-principal Investigator William Roggenthen of the South Dakota School of Mines and Technology.

"By the end of next summer, we hope to complete a preliminary design of the facility and then integrate with it a generic suite of experiments," Lesko said. "While formal selection of the experiments will not have been made by that time, we know enough about them now that we can move forward with the preliminary design."

In preparation for the design work, more than 200 potential DUSEL researchers met in the city of Lead Sept-30-Oct. 3 to attend the first meeting of scientific users. At that meeting, the UC Berkeley and South Dakota team began gathering the scientific requirements from users for integration into the proposal. The users include not only the 16 collaborations chosen by the NSF to develop conceptual designs, but more than a dozen other collaborations. In addition to the physics and astrophysics experiments, these include studies of the fracture network in rock and searches for exotic forms of life at the extreme temperatures and pressures underground.

The DUSEL team continues to work closely with the South Dakota Science and Technology Authority, financed by Sanford and the state of South Dakota. The SDSTA manages the rehabilitation of the Homestake site and the creation of Sanford Lab. ◆

To read more about this story or DUSEL in the news:
CERN Courier, 8/25/09 - http://cerncourier.com
Black Hills Pioneer: http://www.bhpioneer.com
Rapid City Journal: http://www.rapidcityjournal.com
Rapid City Library: http://dusel.wikidot.com/in-the-news

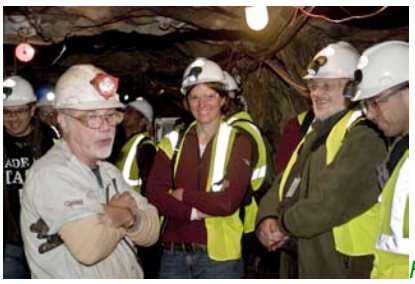

Figure 3: Workshop participants tour mine at 4100-foot level. Tom Trancynger offers safety tips. Also left to right: Drs. Alberto Lemut and workshop coordinator Daniela Leitner (both LBNL); Michael Wischer (Notre Dame University) and Michael Famiano (Western Michigan University).

Workshop on DUSEL SCIENCE and Development of the MREFC

On September 30–October 3, approximately 200 scientists from the Physics, Biology, Geology and Rock Engineering community attended the Workshop on DUSEL SCIENCE and Development of the MREFC (Solicitation 4 or S4). Attendees divided into plenary sessions for status updates from the agencies, the facility planning team and Sanford Laboratory, as well as parallel sessions and breakout sessions with small discussion groups. In addition to the S4 awardees, members of science groups who were not part of the S4/S5 process discussed possible future underground experiments, timelines, status of proposals, R&D, and other

requirements. Collaborations and workgroups identified several key contact points to interact with the facility and met staff responsible for designing the facility. The facility team introduced a new database to facilitate communication between collaboration and design team. Peggy Norris organized an Education and Outreach luncheon to facilitate points of contact and collaborations between work groups and Sanford/DUSEL E&O efforts. She also discussed the current E&O program at Sanford Laboratory.

Physics groups organized into several workgroups to plan S-4 projects and discuss specific requirements with facility teams or to organize proposals and R&D activities for new experiments. During the parallel session, 15 Physics talks were presented and discussed among the various science groups laying out a broad and far-reaching physics program for the underground laboratory.

Figure 4: Bryce Pietzyk points out mine and mine safety highlights to S4 tour group.

About 50 representatives from the Biology, Geology and Rock Engineering community attended Biology, Geology and Engineering breakout sessions and workgroup meetings. Many of these belonged to the seven projects which were recipients of S4 funding from NSF, the DUSEL CO_2 Facility, the Ecohydrology Project, the Fracture Processes Facility, the Coupled Processes Facility, the Transparent Earth project, the Strain Monitoring project, and the Large Cavern Design and Engineering project. Participants who were not part of the S4 teams also proposed new experimental approaches that could be implemented at DUSEL. These included Phil Long from PNNL, Kirk Nordstrom from USGS, Ze'ev Reches from University of Oklahoma, Ramunas Stepanauskas from Bigelow Laboratory, and Emmanuel Detournay from the University of Minnesota, among others. Fifteen talks outlining these experiments were given during the course of the workshop. Two three-hour sessions at Sanford Laboratory with the Vulcan 3-D mine database enabled many projects to identify the levels and locations for their specific experiments. Each participant in the Vulcan sessions was supplied with database files for use in developing their Preliminary Design Reports (PDRs). The Ecohydrology, DUSEL CO_2 Facility and the combined Fracture Processes and Coupled Processes facilities met over the course of four hours to formulate their requirements from DUSEL, proposed schedule for occupancy, and R&D requirements.

In addition to the scientific activities of the Physics and non-Physics groups, a proposal was floated to establish a DUSEL Research Association (DuRA) as a representative of the science-user community. The idea was to transition the DUSEL Experiment Development Committee (DEDC) into the inaugural executive body of this group, and to then have this activity accommodated by elected representatives from the community. Plans for discussion within the community and the enactment of some consensus form of this transition are in progress.

The high turnout for the workshop demonstrates the increased momentum for DUSEL experiments and the growing enthusiasm of the community. Many thanks to Sanford Laboratory, South Dakota School of Mines, and the DUSEL facility for organizing this successful event!

LBNE Workshop

On October 4-6, the Long Baseline collaboration meeting was held at the Holiday Inn Express in Deadwood. The meeting was scheduled to start at the conclusion of the MREFC workshop.

This experiment uses a neutrino beam from Fermi National Accelerator Lab in Illinois directed through the earth to a large, underground detector at DUSEL. Approximately 80 scientists attended with interests in the beam line at Fermilab, the near detector at Fermilab, a far detector consisting of a large cavern filled with purified water (100 kTon) or a liquid argon detector, both at DUSEL. Ron Wheeler, Executive Director of the SDSTA gave the opening remarks. His comments were followed by talks from Dr. Kevin Lesko (DUSEL PI) on the status of the DUSEL proposal, Steve Marks on the

infrastructure available for experimentalists, Zbigniew Hladysz on the recent results from the geotech work, and Dr. Sydney De Vries on the status of the current infrastructure, including the upgrading of the Ross and Yates Shaft. Thereafter, reports were presented from the four major sub-projects, listed above.

For the next one and one-half days, attendees divided into four working groups. The major goal of the meeting was to create schedule milestones and deliverables for each of the groups which could be used as input for the DUSEL preliminary design report due in December of 2010, and the expected Department of Energy critical decision 1 (CD1) review of the long baseline neutrino experiment expected about the same time. Schedules, milestones, deliverables, and risks were presented by each sub-group at the conclusion of the meeting.

As part of this meeting, nominations were made for the spokesperson, and several potential names for the scientific collaboration were suggested.

Figure 5: On October 7, some LBNE attendees took underground tours at the 4100-foot level. Peggy Norris, front row, 3rd left. During the week of these workshops, 283 scientists met in Lead and toured underground.

DUSEL Updates

In addition to the above workshops, DUSEL also held two major reviews: the DUSEL Internal Review (August 31–September 3) and the NSF In-Progress review (September 22-25). Recommendations from the DUSEL Internal Review and the NSF In-Process Review, and the review report of the preliminary design proposal have been added to the review-tracking database.

Technical progress continued in geotechnical studies, underground infrastructure assessment and basis of estimate and surface facilities. E&O activities are being pursued with assistance from a project management team placed under contract. The final two major design subcontracts will soon be signed.

Surface Infrastructure Alterations and Upgrades

The Project received a proposal from HDR CUH2A for preliminary design services for the Surface Facilities Infrastructure contract. The existing contract is being amended to fund preliminary design activities. A complete all-subcontractors integration meeting is planned in the near future.

Infrastructure for Underground Operations

An action plan was developed to address concerns raised during initial assessment of the condition of the Ross Shaft and its current use. A follow-up inspection including SRK and Tiley using non-destructive testing (NDT) was performed on September 27-30. This updated the initial visual assessment and more NDT is scheduled. A second basis-of-estimate workshop was held with ARUP as progress continues in this area.

Geotechnical Site Investigations

Site mapping of the 4850L was completed and the final report received.

Geotechnical site coring and testing investigations are progressing well. About 2800 feet have been drilled and logged. Figure 6 shows the current drilling plan. As of October 28, Hole C reached a depth of 533 feet as it is about 100 feet from the LC3 preliminary location. Drilling is slower in rhyolite. So far, the rock quality and properties are good enough to proceed with the siting of LC1 and the Laboratory Modules as initially suggested. We note that placing the large cavities within the swarm of rhyolite dikes seems unavoidable. The documented rock mass meets the criteria for construction at this point. There is a lower frequency of rhyolite dikes inside the triangle of drifts than expected. The Geotechnical Advisory Committee and the Geotechnical contractor concur that there is no reason to change the plan at this point.

Low quantities of water are flowing out of some holes (less than a quarter of a gallon/minute). Water pressure and outflow is being monitored.

The first phase of *televiewer* logging (in holes 2, 3, M and N) and six *in situ* stress measurements using

a hollow-inclusion cell have been completed. The raw data are being interpreted and analyzed.

Zbigniew Hladysz, Bill Roggenthen and Geotechnical Advisory Committee members recently met with the Golder Design Team for a three-day review of the available geotechnical data and test results.

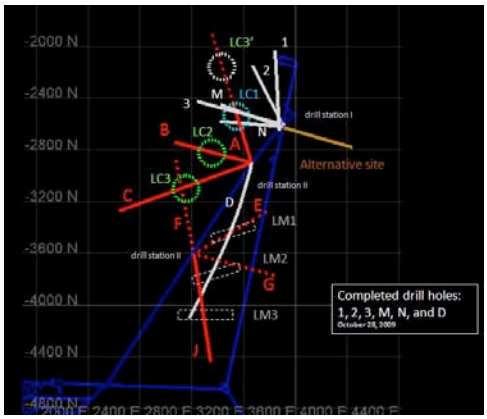

Figure 6: The planned geotechnical-coring plan on the 4850L is presented. Holes 1, 2, 3, M, N and D have been completed and logged. Hole C has extended beyond the LC3 location.

SANFORD UNDERGROUND LABORATORY AT HOMESTAKE

Article from: Black Hills Pioneer, October 2, 2009 (Wendy Pitlick)

LEAD — Planned research programs, education and outreach, and impressive local support provide an unusually strong foundation for the design of the DUSEL, a National Science Foundation official said Thursday.

Dr. Jonathan Kotcher, Program Officer with the NSF, updated a group of about 200 scientists about the progress of the DUSEL plans from the federal agency's perspective. Kotcher reported that the first installment of the newest award for the DUSEL preliminary design of $29 million over two years is expected to be distributed Nov. 1. That money adds to the $15 million the NSF granted the DUSEL team when Homestake was selected as the preferred site for the deep underground laboratory in July 2007, as well as a supplemental $3 million. Overall to date the NSF has committed $47 million to the preliminary design of DUSEL.

Those funds, combined with more than $21 million that was recently awarded to scientists to design and engineer experiments for the DUSEL, have produced a strong research and development program and the resources the DUSEL team will need to submit a successful proposal.

"There is a lot of momentum, a lot of force behind this thing," Kotcher said. "The site selection announcement was only two years ago. Since then enormous progress has been made on all fronts. Still, so much remains to be done. The coming months are critical. We always say this, but this time it really is true. The goal is a baseline design that reflects the full potential of this unique and very special project."

Dr. Kevin Lesko, principal investigator for the DUSEL proposal, said this next year will be very intense as his team works with scientists to incorporate the engineering for their experiments with the preliminary design for the DUSEL. He said up until this point his team has been working with scientists who had not received funding to design and engineer their experiments. But the science awards announced last month have kicked efforts into high gear, as scientists can now make real plans to move underground. Now, Lesko said, the DUSEL team has one year to integrate all of those detailed plans into the preliminary design to be presented to the NSF in December 2010.

"We're starting to work with the collaborations and work with their engineers so we can get very specific details out of them," Lesko said. "They have had marvelous ideas of what they want to do here and how they want to do it. Now it's time to put pencil to paper and do some engineering and calculations."

Part of that planning is allowing the scientists to use software that will help them decide where in the lab they will put their experiments. Starting Thursday morning a Vulcan database was made available so scientists could examine a three-dimensional view of the former Homestake gold mine in order to determine what areas will be available for their experiments.

"I think the next 12 months is the very intense period of putting all of these pieces together," Lesko said. "(We will have) 12 months of very intense engineering and design work, crafting the documents, and (we will be) reviewing the documents in the last quarter of the year (2010)."

Kotcher outlined the National Science Foundation timeline for the scientists on Thursday, saying that January 2009 was the first NSF review for the proposal. Another review will be held in January 2010. Then, in December of 2010 the preliminary design review is expected to be completed, and in the spring of 2011 the National Science Board will hear a presentation about the DUSEL to determine whether the project goes to Congress for approval. Under this timeline, Kotcher said, construction could start in fiscal 2013.

Kotcher reported that it is critical for the scientific community to continue working closely together in order to ensure success for DUSEL. Workshops such as the one held in Lead, and close communication between the scientific collaborations and the DUSEL team, are of utmost importance and will become even more important as the year goes on, since the success of the DUSEL proposal is wholly dependant on support from the scientific community.

"The absolutely necessary ingredient for success is and will remain close community collaboration," he said. "The community must now specify their vision of what DUSEL will be."

While scientists are ramping up their efforts for DUSEL, Sanford Lab officials are diligently working to develop a state-run facility at the 4,850-foot level for early science in the former gold mine. Excavation started at the lab last week and will continue until March of 2010, when actual lab construction will start. The entire construction project for the state's interim laboratory is expected to be completed by July 2010. Scientists with the LUX (Large Underground Xenon) collaboration, which plans to fill a massive underground detector with liquid xenon to search for dark matter at Homestake's 4,850-foot level, hope to install their experiment underground as soon as possible. Additionally, scientists with the Majorana collaboration, an experiment that will determine whether neutrinos are their own antiparticle, are also planning an early implementation program in the Sanford Lab and are looking forward to getting underground.

The Sanford Lab is being developed using state dollars and a large, $70 million gift by Sioux Falls philanthropist T. Denny Sanford. The DUSEL team is developing their proposal using the federal dollars. Though the two entities are working together toward the common goal of developing a federally funded underground laboratory in Lead, the organizations are distinctly separate from each other in terms of funding mechanisms and management. ◆

Figure 7: "I never thought a pile of rock could look so beautiful," commented Willy McElroy. The above rock pile is the result of the first blast at the 4850 level.

Blasting at the 4850 Level

By the end of September, Engineering Project Manager Willy McElroy estimated that the crew had removed 100 to 125 tons of rock, all being emptied into the existing Yates rock dump near the excavation site. Dump capacity is approximately 1500 tons. Ecology and green-conscious, when they have filled the rock dump, they will cover it with concrete and bridge decking which will make a nice entrance to the new lab.

Drift Round on the 4850L

Excavation crews continue to make progress at Davis Cavern on the 4850 Level for the LUX and Majorana experiments. Crews have nearly completed the widening of the beginning of the existing "drift" (tunnel) that leads from the Yates Intersection to the Davis Chamber. Soon they will begin to tunnel or drift about 320 feet to the large chamber.

Engineering Director Chris Zimmer provided the Figure 8 graphic (below), which illustrates how holes will be drilled for the explosives that will excavate the drift.

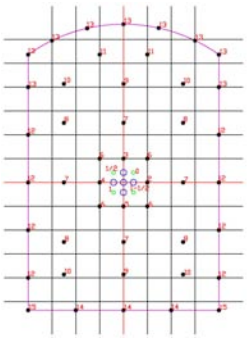

Figure 8: Left-hole pattern for drift round that will produce an "arch drift" 12 feet high x 8 feet wide.

The five blue circles in the center represent holes that are three inches in diameter. These provide a "relief" space into which the rock can break. Electric blasting caps fire from the center out, breaking rock into the center of the drift round. Blasts are set off in an alternate repeating pattern: first, a diamond shape, then a box shape, then a diamond, and so on. A 10-foot drift round breaks up about 100 tons of rock, according to Zimmer.

EDUCATION AND OUTREACH PLANNING

Figure 9: Students at Education and Outreach event

Early Activities: Sanford Laboratory hosted 65 eighth-grade students and 10 teachers and chaperones from the Custer School District on September 23. The students built sand filters and filtered mine water, running various tests on the filtered water. They had a geology talk at the Open Cut, and toured the Yates hoist room and the water treatment plant.

Special thanks to Connie Giroux, Julie Dahl (BHSU), Tom Trancynger, John Scheetz, and the crew at the water treatment plant for their willingness to donate their time and for their enthusiastic interactions with the students.

Sanford Laboratory sponsored an exhibit table at the Indian Education Summit, held in Rapid City on September 28 and 29. Peggy Norris, Bill Harlan and Connie Giroux manned the table and talked with various educators and students.

Sanford Laboratory also participated in Space Days on October 1-2. Space Days--sponsored by the South Dakota Space Grant Consortium, its member institutions, and NASA--is an annual event that moves around the state. Held in Rapid City at SDSMT this year, the program was organized by the Journey Museum, SDSMT, BHSU and Sanford Laboratory, and attracted 865 area middle and high school students. Besides having an exhibit, Peggy Norris gave three talks to crowded auditoriums about the formation of elements in supernovae. Mike Dragowsky, from Case Western University, a postdoctoral fellow on the LUX collaboration, gave two talks on dark matter. The talks were received with enthusiasm by the students, with many questions.

Sanford Lab Director Jose Alonso Retires

Dr. Jose Alonso announced his retirement from Sanford Lab as of October 15. Alonso plans to remain involved with the project, possibly in lab experiments. Ron Wheeler, Executive Director of the SD Science and Technology Authority, has asked Dr. Alonso to stay on as Emeritus Laboratory Director.

Figure 10: Dr. Jose Alonso (left) celebrates after starting the first pump dewatering of the former Homestake mine.

This is a second retirement for Alonso, who originally retired in 2002 after a 30-year career at Lawrence Berkeley National Laboratory. He was involved with the Large Hadron Collider at CERN in Geneva, Switzerland before taking the position of Sanford Lab Director in 2007.

In his new role as Emeritus Director, Dr. Alonso will continue to present public lectures on underground science and progress at Sanford Lab.

Dave Bozied, a charter member and former chairman of the S.D. Science and Technology Authority passed away on October 7 due to esophageal cancer. Bozied, 60, served on the SDSTA board since its creation in 2004. The Board was created by South Dakota Governor Rounds to oversee the project to re-open the former Homestake gold mine and develop a science lab at the 4850-foot level. In addition to his work with the S.D. Science and Technology Authority, Bozied also served on a number of other statewide boards.

Figure 11: Dave Bozied (right) with Operations Director Greg King in Ross cage during a trip underground (2008).

ENVIRONMENT, HEALTH & SAFETY

A safety walkthrough by external specialists in advance of the NSF In-Process review was conducted, and progress continues on the development of the Integrated Safety Management System (ISMS). Specific and immediate compensatory measures have been undertaken from all three inputs – internal review, independent walkthrough, and NSF review (for example: the South Dakota Science and Technology Authority issued a new visitor policy) and specific actions have been undertaken in congruency of DUSEL EH&S policy and SDSTA implementation. Discussions and exploration with LBNL EH&S has been pursued to assess the applicability of adapting its Job Hazard Analysis system for DUSEL/SDSTA. Docushare has been populated with DUSEL EH&S documentation and can be viewed at https://docs.sanfordlab.org.

Halloween Safety

Keep an eye on candles inside of jack-o-lanterns to avoid fire. You could use flashlights instead of candles.

Carry a flashlight when trick-or-treating after dark.

Keep pets inside so they will not become frightened.

Happy Haunting!

**** FOR INFO ON WEATHER CONDITIONS IN SOUTH DAKOTA, CALL: 605-722-0002***

JOBS

DUSEL is seeking an Education & Outreach Director. For more info, please refer to the ad:

https://yourfuture.sdbor.edu/applicants/jsp/shared/frameset/Frameset.jsp?time=124810512964

Postdoc or Research Associate position: The neutrino physics group, Physics Department, Stanford is seeking qualified applicants for a postdoctoral or Research Associate position on EXO. To apply, please send your statement of interest with CV and list of publications to Ms. Marcia Keating, Varian Physics, Stanford, CA 94305-4060 by letter or email (mkeating@stanford.edu).

WORKSHOPS / CONFERENCES

Special Session on Underground Science at the Fall Meeting of the American Geophysical Union

For researchers working at underground labs, including DUSEL: the morning oral session and afternoon poster session will include 29 papers describing science activities at underground research facilities worldwide. BGE DUSEL S4 projects will be showcased alongside ongoing investigations at existing labs, providing an excellent forum to exchange ideas and develop new collaborations. Meeting dates: December 14-18, 2009. Location: San Francisco. For more info: http://www.agu.org/meetings/fm09/

International Workshop on Stopping and Manipulation of Ions and related topics (SMI-10), Stanford University – March 21-24, 2010

This workshop continues the series of meetings begun in 1986 in Konnevesi, Finland. The scope of these meetings has followed the evolution and expansion of the techniques related to the stopping of energetic ions in noble gases and the use of noble gases to manipulate ions and atoms, mostly in research involving unstable nuclides. In addition SMI

10 will cover topics of interest for the extraction and identification of ions produced in rare nuclear decays, such as would be desirable for ultra-low background double-beta decay experiments. The many new developments since the last workshop in this series in 2006 in Groningen warrant the organization of this meeting. The SMI-10 Workshop aims at providing a status of the field as well as guidance for future developments. For more information, contact Ms. M. Keating, mkeating@stanford.edu.

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