

Underground nuclear-reaction experiments for astrophysics and applications

International Workshop in Dresden/Germany, 28.-30.04.2010

The field of underground accelerator physics to study rare nuclear reaction events has greatly expanded over the last decade. Consequently, there is an increasing need to put ion accelerators in underground laboratories, making use of overlying rock to suppress cosmic-ray induced background.

This technique was pioneered by the LUNA collaboration. LUNA installed two accelerators (50 kV and 400 kV, respectively) in 1994 and 2000 in the Gran Sasso deep underground laboratory in Italy. The favorable background conditions at Gran Sasso enabled low-countrate experiments that could access for the first time directly the astrophysically relevant energy range. The LUNA machines aim to serve the nuclear reaction data needs of the astrophysical community. Their success in studying stable hydrogen burning has opened an era of precision in the understanding of our Sun and of the universe. However, many other astrophysical scenarios such as explosive hydrogen burning, helium burning, and the neutron sources for the s-process cannot be studied at LUNA due to its limited energy range.

An underground accelerator with increased energy range would, in addition to the mentioned astrophysical scenarios, open the door for materials science methods such as ultra-low trace element detection to push their sensitivity limits much lower. Activation experiments with underground gamma-counting have the potential to serve the data needs of the particle physics community aiming to eliminate the background in experiments dedicated to studying rare processes.

At several European sites, most notably Gran Sasso / Italy and Canfranc / Spain, efforts are underway to host an accelerator of a few megavolts in a deep-underground setting, dedicated to astrophysics. Another option has recently emerged to install an accelerator near an existing γ -counting facility in a shallow-underground laboratory, Felsenkeller/Dresden, with the scope encompassing some of the higher-yield astrophysics reactions as well as particle physics and materials science inspired studies. The Felsenkeller facility is close to Forschungszentrum Dresden-Rossendorf (21 km) and TU Dresden (5 km).

The workshop aims to gather Europeans interested in underground accelerators from the nuclear physics, astrophysics, particle physics, and materials science communities. It should explore data needs, new experimental approaches able to fill these needs, and also include assessment of relevant theory required to exploit such experiments. Ideally, the workshop should foster the emergence of an informal European alliance to develop the exchange of ideas and techniques, students, and postdocs.

Topics:

1. Nuclear data needs from astrophysics
2. Nuclear theory relevant to astrophysics
3. Nuclear data needs from particle physics and materials science
4. Recent experimental results
5. Future high-current stable beam accelerators

Schedule:

The workshop will start on Wednesday, 28 April 2010, at 9:00, and will close on Friday, 30 April 2010, at 13:00. Friday morning, 9:00 – 13:00, will be devoted to a special session for participants from German institutions.

Venue:

Dresden, a city of 500,000 and capital of the region of Saxony, is located near the geographical center of Europe. With 20 flights per day arriving in Dresden from the hubs Frankfurt, Munich, and Dsseldorf, Dresden is only two flights away from most major European cities. The workshop is co-sponsored by Forschungszentrum Dresden-Rossendorf (FZD) and Technische Universitt Dresden (TU Dresden). FZD is a state-run research institute with a staff of 750 and an annual budget of 73 MEuro. TU Dresden has 36,000 students and runs one of the largest university physics programs in Germany.

The workshop will take place at FZD, in Dresden-Rossendorf (address: Bautzner Landstr. 400, 01328 Dresden-Rossendorf). A valid photo ID is required in order to enter the FZD compound. **Participants are responsible for booking their own hotel room.** We suggest workshop participants to reserve a room in Hotel [Leonardo Dresden Altstadt](#) (click on the link for details; please quote password "Felsenkeller"). There will be shuttle buses in the morning and in the evening from this hotel to the workshop location at FZD. In addition, some economic accommodations are available directly in the FZD guesthouse in Rossendorf. On Wednesday afternoon, a visit to the Felsenkeller site is foreseen. On Wednesday night, there will be a social dinner in the city center. Transport will be organised.

Format, attendance, and cost:

In order to encourage open discussion, the goal is to have about 30 participants. Applications are hereby solicited. Participants should register by e-mailing the registration form to the organizers by 25.03.2010 and include a title of presentation, if desired. An attendance fee of 70 Euros to cover buses, lunches, coffee breaks, and social dinner is requested. Limited financial support for travel and accommodation is available upon request.

Scientific advisory committee:

Carlo Broggin, INFN Padua/Italy
Roland Diehl, Max-Planck-Institut für extraterrestrische Physik, Garching/Germany
Zsolt Fülöp, ATOMKI Debrecen/Hungary
Brian Fulton, University of York/United Kingdom
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Local organizing committee:

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Workshop web site:

<http://www.fzd.de/felsenkeller>

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