

European Strategy for Particle Physics Update - Input from low-energy nuclear physics in Belgium

Contact person

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The research objectives of the experimental low-energy nuclear physics groups in Belgium are in line with the European strategy for nuclear physics as outlined in the Long Range Plan 2017 of the Nuclear Physics European Collaboration Committee (NuPECC: <http://www.nupecc.org/pub/lrp17/lrp2017.pdf>). In particular, the focus for the groups lies on Isotope On-Line (ISOL) research and the related developments at CERN-ISOLDE, GANIL-SPIRAL2 and the long-term perspective of EURISOL.

- obtain spectroscopic information (moments, transition probabilities, spectroscopic factors) on states of key nuclei far from stability, to link shell structure evolution with the properties of the underlying effective nucleon-nucleon interaction and explain the microscopic origin of shape transitions and coexistence;
- collect atomic and nuclear data on trans-uranium elements to refine global models that can be used to predict properties of the superheavy-element region and of the heavy, very neutron-rich nuclei situated at the end of the r-process nucleosynthesis;
- set new limits for the physics beyond the Standard Model using low-energy, high-precision measurements of the nuclear beta-decay and neutron electric dipole moment;
- study the production and handling aspects of new radioisotopes and beams for medical applications, diagnostics and therapy.

Those objectives rest on the exploitation of the present possibilities and realisation of new infrastructure at CERN-ISOLDE, where most of our research is performed. Concerning new infrastructure at ISOLDE we strongly support the points raised in the EPIC project (Exploiting the Potential of ISOLDE at CERN):

- the implementation of the capabilities of the new LINAC4 and upgraded PS-Booster into the ISOLDE target/ion source stations to increase the intensity of radioactive ion beams;
- the construction of new target stations and a radioactive beam distribution system to increase the radioactive ion beam time, along with the realisation of a high-resolution separator for isobar and isomeric separation and purification;
- the finalisation of the HIE-ISOLDE upgrade of the post-accelerator, to benefit from the full range of energies relevant for research on nuclear astrophysics and nuclear reactions;
- the deployment of a storage ring beyond the HIE-ISOLDE post-accelerator, to implement new, unique techniques for nuclear and atomic research.

At other European facilities we support:

- the finalisation and commissioning of the new high intensity heavy ion accelerator and the S3 separator-spectrometer at GANIL-SPIRAL2, with the REGLIS3 (Rare Elements in-Gas Laser Ion Source and Spectroscopy at S3) gas cell comprising the S3 Low-Energy Branch;
- the realisation of the low-energy DESIR facility at GANIL;
- the finalisation of the SPES radioactive ion beam facility at the Legnaro National Laboratories (Italy).

In the long term, we aim at the realisation of the multi-beam, multi-user EURISOL facility with a 4-MW main production target. As an intermediate step we support the EURISOL Distributed Facility (EURISOL-DF), which will organise and develop the R&D on beam production and instrumentation performed at different locations. An important role within EURISOL-DF will be played by the realisation of the high-power Proton Target Facility (PTF) at the MINERVA facility, the first phase of the MYRRHA project at SCK•CEN in Belgium.