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The SPES Radioactive Ion Beam Project at INFN: Status and perspectives

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Magic numbers are a key feature in finite systems of Fermions since they are strongly related to the underlying mean field. The evolution of the shells far from stability can be linked to the shape and symmetry of the nuclear mean field. The study of nuclei with large neutron/proton ratio allow to probe the density dependence of the effective interaction. Changes of the nuclear density and size in nuclei with increasing N/Z ratios are expected to lead to different nuclear symmetries and excitations. Recently it has been shown that the tensor force play an important role in breaking and creating magic numbers, being a key element of the shell evolution along the nuclear chart.
These studies are among the objectives of the SPES radioactive ion beam project of INFN. The SPES Radioactive Ion Beam (RIB) facility at INFN-LNL is presently in the construction phase.
The aim of the project is to provide high intensity and high-quality beams of neutron-rich nuclei to perform forefront research in nuclear structure, reaction dynamics and interdisciplinary fields like medical, biological and material sciences. SPES is a second generation ISOL radioactive ion beam facility. It represents an intermediate step toward the future generation European ISOL facility EURISOL. The SPES project is part of the INFN Road Map for the Nuclear Physics; it is supported by the Italian national laboratories LNL (Legnaro) and LNS (Catania). It is based on the ISOL method with an UCx Direct Target able to sustain a power of 10 kW. The primary proton beam is delivered by a Cyclotron accelerator with an energy of more then 40 MeV and a beam current of 200 microA. Neutron-rich radioactive ions will be produced by Uranium fission at an expected fission rate in the target of the order of 10^13 fissions per second. The exotic isotopes will be re-accelerated by the ALPI superconducting LINAC at energies of 10A MeV and higher, for masses in the region of A=130 amu, with an expected rate on the secondary target of 10^7-10^9 pps. The present status and the perspectives of the project will be presented together with the related detector developments.

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