EURISOL User Group
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Neutron deficient exotic nuclei and
the Physics of the "proton rich side" of the nuclear chart

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Shape coexistence in heavy nuclei

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A remarkable feature of the atomic nucleus is its ability to take on different mean-field shapes for a small cost in energy. Since this phenomenon is a strong challenge to state-of-the-art theory, experimental data can provide a discriminating test of competing models. A strong focus for explorations of nuclear shape coexistence in recent years has been the region around the light lead nuclei. Both prolate and oblate shape minima are found to compete favourably with the spherical ground state. The prolate minimum reaches its lowest energy around the neutron mid-shell (N=104) and this trend has has been recently confirmed with the observation for the first time of excited states in the extremely exotic nucleus, 180Pb. These results will be presented.
Increasingly, the focus has shifted to measurement of matrix elements which can impose even more stringent tests of nuclear models. Very recently, the scope for extracting matrix elements has been opened up at REX-ISOLDE where accelerated ISOL beams of very heavy proton-rich nuclei are uniquely available. Coulomb excitation can be used to extract both transition and diagonal matrix elements; the latter giving information on the sign of the nuclear deformation. Recent results on Coulomb excitation of the light mercury and radon will be presented. This work has been complemented with experiments to obtain independent information on transition matrix elements using plunger lifetime measurements. Studies of excited states in the light radon and mercury nuclei have also been carried out using the novel SAGE spectrometer at the University of Jyvaskyla, where conversion electrons can be detected in coincidence with gamma rays. This approach can be used to search for E0 transitions and E0 components of J-J transitions which are an important further insight into shape coexistence in these nuclei. Preliminary data from both the plunger and SAGE measurements will be presented.
In the future, the HIE-ISOLDE facility at CERN will provide accelerated beams of heavy neutron-deficient nuclei up to 10 MeV/u. This will allow multi-step Coulomb excitation as well as the opportunity to probe the shape coexistence in still further detail by means of transfer reactions. An outline of these possibilities will be given.
The work to be presented represents the contribution of many individuals and groups from the MINIBALL/REX-ISOLDE collaboration and the SAGE/JYFL collaboration.

Summary

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