Contribution ID: **12** Type: **Contributed Oral/Poster**

Recent results on direct reactions with stored radioactive beams and with active targets

Friday, 15 July 2016 09:55 (15 minutes)

The investigation of direct reactions with radioactive beams in inverse kinematics has already been proven to be a valuable tool for providing important information on the structure of exotic nuclei. In particular, it turned out that in many cases essential nuclear structure information can be deduced from high-resolution measurements at low momentum transfer. Such experiments can favourably be performed either by using the experimental technique of active targets, or, with even higher luminosities, with the new and innovative method of using stored and cooled radioactive beams interacting with thin internal targets at storage rings. The latter technique, due to the thin windowless targets and to beam cooling, enables high resolution measurements down to the region of low momentum transfer with very low recoil energies, and provides a gain in luminosity from accumulation and recirculation of the radioactive beams.
Consequently a dedicated innovative experimental setup was designed, constructed, and installed at the ESR storage ring at GSI by the EXL [1] collaboration, and successfully used for a –even on a world-wide scale – first reaction experiment with a stored radioactive beam. The experimental concept will be discussed and the results of the experiment with a stored radioactive 56Ni beam, where the nuclear matter distribution of the doubly magic 56Ni nucleus was investigated by elastic proton scattering, and a feasibility study on 58Ni(α,α') inelastic scattering, where it was demonstrated that the Giant Monopole Resonance in 58Ni can be investigated by the present technique down to cm angles below 1 degree, will be presented.
As alternative method for low momentum transfer measurements, in particular for very short lived nuclei with lifetimes below 1 sec, the technique of active targets is well suited. An overview on recent results, obtained with the IKAR active target on nuclear matter distributions of the proton halo candidate 8B, and of neutron rich carbon isotopes, obtained from intermediate energy elastic proton scattering, will be presented.

[1] EXL: EXotic nuclei studied in Light-ion induced reactions at the NESR storage ring

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Track Classification: New instrumentation for direct reaction studies of exotic nuclei