

Status of the analysis of the first EXL experiment at the ESR*

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EXL (EXotic nuclei studied in Light-ion induced reactions) is a project within NUSTAR at FAIR that aims to investigate nuclear structure at storage rings with direct reactions in inverse kinematics. The investigations are focussed towards very low momentum transfers where, for example, the nuclear matter distribution, giant monopole resonances or Gamow-Teller transitions can be studied [1].

The existing storage ring ESR at GSI, together with its internal gas-jet target, provides a unique opportunity to partially perform this kind of experiments already now. In 2012, we successfully performed an experiment (E105) with stable ²⁰Ne, ⁵⁸Ni as well as radioactive ⁵⁶Ni beams interacting with H₂ and ⁴He targets. The target recoils were measured by a newly developed UHV compatible detector setup based on DSSDs and Si(Li)s (for further details, see [2]).

The main goal was to measure the differential cross section of ⁵⁶Ni(*p,p*) at 390 MeV/u in order to deduce the nuclear matter distribution of ⁵⁶Ni. Figure 1 shows the pre-

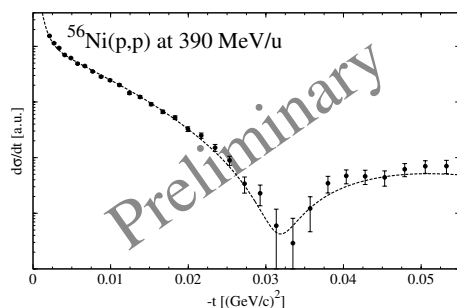


Figure 1: Preliminary differential cross section

liminary differential cross section obtained for this reaction as a function of invariant momentum transfer squared, *t*.

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The dashed line corresponds to a fit to the data using Glauber multiple-scattering theory. In this case, the density distribution of the nuclear matter was parametrized with a symmetrized Fermi-function whereby a preliminary RMS point matter radius of 3.5 fm was extracted. This experiment can be considered as the first successfully observed nuclear reaction with stored radioactive beam, ever.

Additionally, proof of principle measurements were performed using a ⁵⁸Ni beam at 100 MeV/u interacting with a ⁴He target to show the feasibility of investigating giant resonances with EXL [3]. Figure 2 shows the preliminary double-differential cross section for the α inelastic scattering. The dominant contribution is from the IsoScalar Giant Monopole Resonance (ISGMR) excitation. The preliminary results are comparable with previous experiments performed in normal kinematics [3].

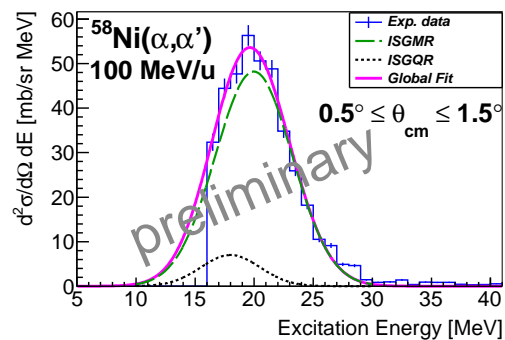


Figure 2: Preliminary double-differential cross section

The experimental campaign has successfully demonstrated the feasibility of the EXL concept and first physics results are on the way. An upgraded detector setup covering larger solid angle is envisaged to be implemented for further reaction experiments at the ESR or the CRYRING at FAIR.

References

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