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Scattering Studies at the SEC (XT03) beamline at HIE-ISOLDE

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The SEC (Scattering Experiments Chamber) at the XT03 Beamline of HIE-ISOLDE is an experimental station to facilitate diversified reaction experiments. The chamber is sufficiently big to accumulate a variety of charge particle detectors as well as scintillator detectors for gamma detection. It is equipped with a rotational disc of 50 cm radius radially graduated and supplied with Al-bars for precise support and positioning of detectors. This makes SEC a versatile station for reaction experiments either to study the structure via the dynamics of the reaction or to study low-lying resonances in light nuclei via transfer reactions.

In this contribution I will present the results of some of the experiments realised at SEC as well as the planned upgrade and future experiments.

The discovery of halo nuclei and the coupling of these weakly bound systems to the continuum have brought renewed interest in the study of nuclear reactions. The presence of halos in the loosely bound system have been highlighted in inverse kinematic studies of relativistic radioactive beams. At the same time, reaction studies of weakly bound systems at energies close to the Coulomb barrier are of great interest due to the interplay between the reaction process and the structure of the projectile. In elastic scattering at low energies the nucleus has time to adapt during the collision, giving rise to unique polarization effects. The Coulomb interaction dominates the reaction process with heavy targets. This manifests in the differential elastic cross section by a strong reduction of the interference pattern. What happen when the target is light or we study a p-halo nuclei?
At SEC, we have studied the elastic scattering of the 1p-halo 8B with a middle mass 64Zn target at energies 1.5 the Coulomb barrier and the debated 1n-halo 15C on a 208Pb target at energies around the Coulomb barrier [1]. In the 8B+64Zn reaction contrary to the 11Be+64Zn case the analysis of the elastic scattering angular distribution shows little suppression of the Coulomb-nuclear interference peak, with no enhancement of the total reaction cross-section [2]. Further, the 7Be(d,p)8Be* transfer-reaction at an high energy of 35 MeV was studied to address a possible increase in the disappearance of 7Be that could help to understand the 7Li abundance anomaly. The higher beam energy, for the first time, allowed the population of high excited states in 8Be up to 22 MeV. The contribution of the 16,63 MeV state to the previously determine S-factor, based only on the gs+3.03+11.35 states, in the Gamow window of 67%. However, this is far from enough to account for the Li abondance discrepancy [3].

I present here on behalf of my colleagues the highlights of these experiments, the setup upgrade and future plans.
References
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[2] R. Spartà et al., Phys Lett B 820 (2021) 136477
[3] Sk M Ali et al., Phys Rev Lett 128 (2022) 252701

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