Contribution ID: **127** Type: **Oral contribution**

Dynamics of 11Be on a gold target at energies around the Coulomb barrier

The study of exotic nuclei has become a central focus of nuclear structure research. The advent of intense secondary beams has allowed for the production and detailed study of the most extreme nuclear systems. The discovery of halo nuclei and the coupling of these weakly bound systems to the continuum have brought renewed interest in the modelling of nuclear reactions. Reaction studies of these 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. The low binding energy and the strong dipolar polarization contribute to a significant enhancement of the breakup cross section, even below the Coulomb barrier [1].

Together with the deuteron, 11Be is the first and the most studied one-neutron halo nucleus with the particular feature that its first excited state (Ex=320 keV, J⊠= ½-) is also a halo state and presents a strong dipolar coupling to the ground state (J⊠= ½+). In this conference, I will present new experimental data for the elastic, inelastic and breakup channels of the 11Be + 197Au reaction at incident energies around and below the Coulomb barrier, with the elastic and inelastic channels separated for the first time in this energy range [2]. The experiment was performed at TRIUMF, using the HPGe detector array TIGRESS in coincidence with Silicon detectors for the identification of the Be fragments. State-of-the-art CDCC calculations including core excitations are able to explain all the scattering distributions simultaneously, and clearly support the latest dB(E1)/dE distribution measured at RIKEN (Fukuda et al [3]). The present study settles the question about the dB(E1)/dE to the continuum of the 11Be and demonstrates that the reaction mechanism is sensitive to subtle structure features, such as core deformation in a halo nucleus. The energy distribution of the breakup fragments for different angular intervals has also been deduced and compared with the different models and kinematic scenarios [4].

[1] J. P. Fernández-García et al., PRL 110, 142701 (2013)
[2] V. Pesudo et al., PRL118, 152502 (2017)
[3] N. Fukuda et al., PRC 70, 054606 (2004)
[4] V. Pesudo et al., in preparation

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