Elastic and break-up of the 1n-halo ^{11}Be nucleus.

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Huge efforts have been done in the last years in major laboratories around the world to understand the reaction dynamics around the Coulomb barrier with neutron halo nuclei. Reactions induced by n-halo nuclei have been extensively studied, in a wide range of energies and on different targets, in order to understand the role played by the halo on the reaction dynamics (see e.g. [1] and ref. therein). In collisions induced by halo nuclei, direct reactions, as for instance transfer or break-up, may be favored owing to the low binding energy, the extended tail of "valence nucleons" and the large Q-value for selected transfer channels. Moreover, the effects of the coupling to the continuum is expected to play a major role on the reaction dynamics. Elastic scattering studies can be an ideal tool to investigate the effect of the long tail of the halo matter distribution. Experimentally, almost all elastic scattering and reaction mechanism studies around the barrier performed with halo nuclei have been made using the 2n-halo nucleus ^{6}He and only recently, results have been published with the 2n-halo ^{11}Li [2]. Only very few experiments have been performed with 1n-halo ^{11}Be [3]. Thanks to the availability of a post-accelerated ^{11}Be beam at Rex-Isolde a rather precise measurement of the elastic scattering and break-up cross-sections for ^{11}Be was possible. In this contribution the results concerning the collisions ^{11}Be+^{64}Zn at energy close to the Coulomb barrier will be reported. The analysis of elastic scattering shows a damping in the angular distribution in the angular region where nuclear and coulomb scattering interfere, signature of long range absorption. In order to evaluate the effects of coupling to the break-up, Continuum Disctretised Coupled Channel calculations have been performed to compute both the elastic scattering angular distribution and the break-up cross-section [4]. The analysis shows that coupling with elastic break-up is of primary importance to produce the observed dumping. Coulomb break-up is responsible for the long range absorption whereas nuclear break-up is affecting the elastic phase-shift and is responsible for an increase of the elastic cross-section at large angles. The energy spectra and angular distribution for break-up have also been extracted. From the comparison with the calculations it seems that direct break-up is not the only mechanism responsible for this cross-section.

[1] L.F. Canto et al., Phys. Rep. 424, 1 (2006).
[2] M. Cubrero et al., Phys. Rev. Lett. 109, 262701 (2012).
[3] M. Mazzocco et al., Eur. Phys. J. A28, 295 (2006).
[4] A. Di Pietro et al. Phys. Rev. C 85, 054607 (2012).

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