Transfer *vs.* Breakup in the interaction of the ^{7}Be Radioactive Ion Beam on a ^{58}Ni target at Coulomb barrier energies

M. Mazzocco[1], D. Torresi[1], L. Acosta[2], A. Boiano[3], C. Boiano[4], N. Fierro[1], T. Glodariu[5], A. Guglielmetti[4], M. La Commara[3,6], I. Martel[2], C. Mazzocchi[4], P. Molini[1], A. Pakou[7], C. Parascandolo[1], V.V. Parker[2],N. Patronis[7], D. Pierroutsakou[3], M. Romoli[3], A.M. Sanchez-Benitez[2], M. Sandoli[3,6], C. Signorini[1], R. Silvestri[3,6], F. Soramel[1], E. Stiliaris[8], E. Strano[1], L. Stroe[5], K. Zerva[7]

[1]*Dipartimento di Fisica e Astronomia, Università di Padova and INFN - Padova, Italy* [2]*Departamento de Fìsica Aplicada, Universidad de Huelva, Spain* [3]*INFN - Napoli, Italy* [4]*Dipartimento di Fisica, Università di Milano and INFN - Milano, Italy* [5]*NIPNE, Romania* [6]*Dipartimento di Scienze Fisiche, Università di Napoli, Italy* [7]*Dept. of Physics, University of Ioannina, Greece* [8]*Dept. of Physics, University of Athens, Greece*

Contact email: *marco.mazzocco@pd.infn.it*

The reaction dynamics induced by light weakly-bound Radioactive Ion Beams (RIBs) in the energy range around the Coulomb barrier is strongly affected by the exotic features of light RIBs. Recent experiments [1] showed that the reaction probability is largely enhanced when compared to reactions induced by stable well-bound projectiles, and that this enhancement is mainly triggered by direct reaction mechanisms, such as transfer and breakup. To investigate the role played by different direct processes and their mutual interplay, we have studied the system ^{7}Be + ^{58}Ni at 22 MeV. The ^{7}Be (S_α = 1.586 MeV) RIB was produced by means of the beam-line EXOTIC [2] at the INFN-Laboratori Nazionali di Legnaro (Italy). A secondary beam intensity of ~ 3x10^{5} pps was achieved. Charge reaction products were detected by means of 4 ΔE (40 μm) - E (1000 μm) silicon telescopes of the detector array DINEX [3] in the angular ranges θ_{lab} = [40°,75°] and θ_{lab} = [115°,150°].

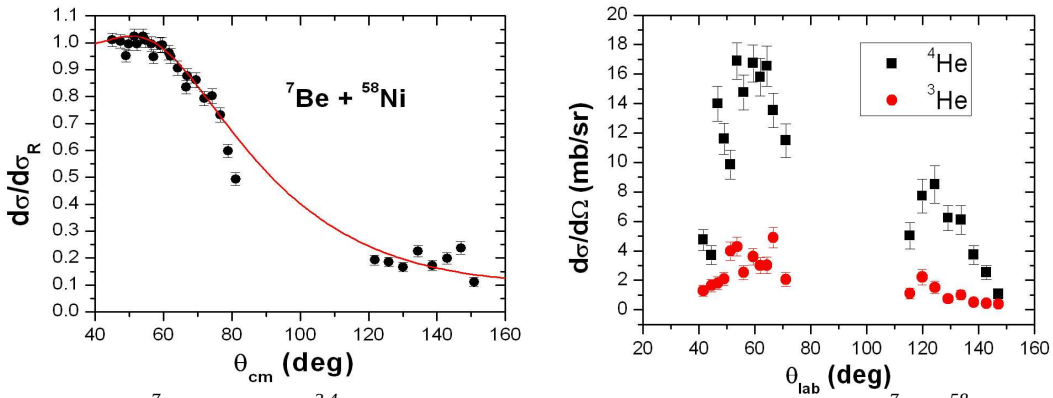

Figure 1: *^{7}Be (left) and ^{3,4}He (right) angular distributions for the system ^{7}Be+^{58}Ni at 22 MeV.*

Fig. 1 left panel shows the ^{7}Be elastic scattering angular distribution, from which we extracted a reaction cross section of 576 ± 20 mb, in good agreement with Ref. [4]. Fig. 1 right panel displays the angular distributions for ^{3,4}He reaction products. Their angle-integrated cross sections sum up to ~ 20 mb and ~ 100 mb for ^{3}He and ^{4}He, respectively. The large difference in the production cross sections for the two helium isotopes indicates that the strongest populated reaction mechanism in this energy range is the ^{3}He-stripping: ^{7}Be + ^{58}Ni → ^{4}He + ^{61}Zn (Q_{gg} = + 9.46 MeV). Moreover, within the statistics collected by our experiment, no ^{3}He-^{4}He coincidences were detected, leading to the conclusion that the breakup channel ^{7}Be → ^{3}He + ^{4}He plays a minor role in the reaction dynamics induced at near-barrier energies by light RIBs (at least) on medium-mass targets.

[1] N. Keeley et al., Prog. Part. Nucl. Phys. **63**, 396 (2009) and references therein.
[2] F. Farinon et al., Nucl. Instrum. Meth. B **266**, 4097 (2008).
[3] A.M. Sanchez-Benitez et al., J. Phys. G **31**, S1953 (2005).
[4] E.F. Aguilera et al., Phys. Rev. C **79**, 021601(R) (2009).