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Study of reactions induced by ^{6}He

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We present the results of an experiment using ^{6}He beam on ^{9}Be and ^{197}Au targets. The collision was measured at the energies E_{lab}=16.2 MeV and 21.3 MeV, using the RIBRAS system (Radioactive Ion Beams in Brazil) of the Institute of Physics of the University of São Paulo [1]. The ^{6}He secondary beam was produced by the ^{9}Be(^{7}Li,^{6}He) reaction with a ^{7}Li primary beam of 300 nA. The detection system consisted of four ΔE-E silicon telescopes, with 20 microns and 1000 microns thickness respectively, which allow to separate the ^{6}He particles from the ^{7}Li beam contaminant and light particles. A high yield of α-particles has been observed in the ^{6}He+^{9}Be collision which was not present with the gold target. The energy and the angular distributions of those events have been analysed and compared with CDCC calculations for the ^{6}He breakup. Furthermore, a strip of events along the ^{6}He line with energies lower than that of the elastic scattering has been observed in the biparametrical spectra obtained using the ^{9}Be target. Their energy and angular distributions have been obtained and compared with Coupled Channels (CC) calculations considering the ^{9}Be excitation. As the excited states of the ^{9}Be are all unbound one can consider those events as a measurement of the target breakup. The angle integrated cross sections have been obtained and compared with the total α-particle production cross sections. The total reaction cross section has been obtained from an Optical Model, Coupled Channels and CDCC analysis of the elastic angular distributions and compared with other exotic, weakly bound and tightly bound systems. An enhancement in the total reaction cross section has been observed for the exotic ^{6}He projectile with respect to the stable ^{6}Li even for the light target ^{9}Be. We found that this enhancement exactly matches the total α-particle production cross section. All the calculations were performed with the computer code FRESCO [2].

[1] R. Lichtenthler et al, European Physical Journal A 25: 259-260, Suppl. 1 (2005);
[2] I.J. Thompson, Comp. Phys. Rep. 7, (1988), 167.