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Elastic scattering of ^{17}O ions from ^{58}Ni at near-barrier energies

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A powerful tool for the study of weakly bound nuclei is the elastic scattering process, which provides a first information on the overall reactivity of the collision participants. We measured the elastic scattering angular distributions for the reaction $^{17}\text{O}+^{58}\text{Ni}$ in order to compare the reactivity of ^{17}O ($S_n = 4.143$ MeV) with its mirror nucleus ^{17}F ($S_p = 0.600$ MeV). The experiment was performed at the Laboratori Nazionali di Legnaro with an ^{17}O beam in the energy range 40.0-50.0 MeV impinging on a ^{58}Ni (150 $\mu\text{g}/\text{cm}^2$) target with a ^{208}Pb (50 $\mu\text{g}/\text{cm}^2$) backing. Three Eres DSSSDs modules of the EXPADES [1] array were placed at $\pm 50^\circ$ ($45^\circ < \theta < 80^\circ$) and $+110^\circ$ ($111^\circ < \theta < 140^\circ$). Data were analyzed within the frame of the Optical Model using both Woods-Saxon and M3Y double-folding potentials. Fig. 1 shows the elastic scattering angular distributions and the optical model best fits for the two approaches. The resulting fit parameters agree with a model describing the ^{17}O nucleus as a ^{16}O core with a valence neutron orbiting in a $d_{5/2}$ state [2]. The reduced total reaction cross sections, shown in the inset of Fig. 1, result to be slightly lower than those of $^{16}\text{O}+^{58}\text{Ni}$ system [3], but higher than those of $^{17}\text{F}+^{58}\text{Ni}$ system [4]. This outcome suggests that, for the pair ^{17}O - ^{17}F , nuclear structure effects play a more relevant role than the projectile binding energy in the reaction dynamics at Coulomb barrier energies.

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