Testing nuclear diffuseness with quasi-elastic barrier distribution

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Quasi-elastic excitation function for the $^{17}O+ {}^{64}Zn$ system was measured at energies near and below the Coulomb barrier, and $\theta_{lab}=161°$. The corresponding quasi-elastic barrier distribution was derived, which has a particular shape, despite the low mass of the projectile and target. The excitation functions for the alpha particle and neutron stripping reactions were also measured, at the same angle and energies, and the experimental values of the spectroscopy factors were deduced by fitting data with theoretical calculations of the code FRESCO. A good agreement was obtained in the comparison of the experimental quasi-elastic barrier distribution with coupled channel calculations including a very large number of channels. Among these channels investigated, three of them dominated the coupling matrix: two inelastic channels, $^{64}Zn(2_1^+)$ and $^{17}O(1/2^+)$, and one-neutron transfer channel. Besides, this analysis shows that a good agreement between data and calculation is only obtained if is used a larger nuclear diffuseness for the ^{17}O nucleus, compared to ^{16}O. The figures below show the comparison of the experimental quasi-elastic barrier distributions of the $^{16}O+^{64}Zn$ with $^{17}O+^{64}Zn$ systems (left), and the coupled channel analysis of the $^{17}O+^{64}Zn$ system (right), where is showed that the barrier distribution was able to evidence the larger nuclear diffuseness of the ^{17}O nuclei, compared to the ^{16}O one.