Fusion, transfer and breakup of light weakly bound and halo nuclei at near barrier energies

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In the last years one has asked whether the complete fusion induced by light weakly bound projectiles, particularly halo nuclei, is enhanced or suppressed when compared with the situation where there is no–breakup process. There are two kinds of effects to be investigated. The first is static effects, caused by the longer tail of the optical potential, owing to the low binding energies of the weakly bound and specially halo nuclei. This effect gives rise to lower and thicker barriers when compared with tightly bound systems, and enhances fusion cross-section at sub–barrier energies not too much below the barrier. The second kind of effect is the dynamic, which is due to the strong coupling between the elastic channel and the continuum states representing the breakup channel. Recent systematic results have shown that the dynamics effects due to breakup and transfer processes enhance the fusion cross section at sub–barrier energies and suppress it at energies above the barrier for stable and neutron-halo nuclei, although for proton-halo systems the behavior is quite different. In this talk we discuss the systematic results, the main open aspects in the field and explain the reason for the systematic fusion cross section behavior. We point out the importance of direct transfer and breakup processes and also the very recently observed sequential transfer followed by the breakup process. Different behaviors of the dynamic polarization potentials at different energy regions are used to explain the observed fusion excitation functions for several light weakly bound projectiles, both stable and radioactive. New measurements with high intensity light radioactive beams, and consequently small error bars, are required to fully understand the coupling of different reaction mechanisms involving halo nuclei, particularly with proton-halo nuclei.