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Fusion mechanism of weakly-bound nuclei

KAZUHIRO YABANA, Institute of Physics, Univ. Tsukuba

Fusion mechanism of nuclei with halo structure is investigated theoretically. We describe the reaction as a three-body problem consisting of a halo nucleon and a core nucleus, which constitute the projectile, and a target nucleus. The three-body dynamics is solved by using the time-dependent wave-packet method. There are several advantages to employ the time-dependent method for the static problem: The method is useful to solve the three-body Schroedinger equation accurately. No explicit boundary condition is necessary to calculate the fusion probabilities from a wave-packet solution. A single wave-packet calculation provides reaction information for a certain incident energy range. The animation of the wave-packet dynamics provides us with intuitive pictures about the reaction dynamics. We find that the fusion probability of neutron halo nuclei is slightly hindered by the presence of the halo neutron, in opposite to a naive expectation that the weakly-bound neutron may enhance the fusion. In contrast, the fusion probability of proton halo nuclei is found to be much enhanced. The fusion cross sections are calculated for ^{6}He - ^{238}U and ^{11}Be - ^{209}Bi reactions, and are compared with recent measurements.