

Fusion–fission of light nuclear systems

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Abstract. Considerable interest has been devoted to fusion reactions between light heavy ions specially between weakly bound ones, due to the anomalous decrease of the fusion cross sections when compared to the total reaction cross section in the energy region around the barrier [1–4].

While the exact nature of the process responsible for the fusion cross section limitation at barrier energies is still unclear, this study shows an inhibition of the yield as the system mass decreases, resulting from the progressive increase of the barrier height and decrease of the effective barrier radius [3]. Furthermore, extensive efforts have been made recently in the study of energy-damped binary yields from light heavy-ion collisions [2,4]. Based on the substantial amount of data accumulated so far, it is now generally accepted and supported by the transition state model [4], that the observed yields arise mostly from a fusion–fission process. Data on complete fusion, fusion–fission and ‘elastic fission’ for the ${}^9\text{Be}$, ${}^{10,11}\text{B} + {}^{10,11}\text{B}$; ${}^{16,17,18}\text{O} + {}^{10,11}\text{B}$; ${}^{19}\text{F} + {}^{12}\text{C}$; ${}^{6,7}\text{Li} + {}^9\text{Be}$, ${}^{12}\text{C}$ reactions among others, are presented. For the loosely bound nuclei it was found that the severe fusion cross section limitation is due to a low survival probability of the weakly bound nuclei until the instant of the collision [1].

Keywords. Nuclear reactions; complete fusion; fusion–fission.

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