Semiclassical theory of fusion and breakup in collisions of weakly bound nuclei

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We describe a semiclassical treatment of fusion and breakup reactions in collisions involving weakly bound nuclei. In this treatment [1], the collision degrees of freedom are treated by classical mechanics while the intrinsic dynamics is described by time-dependent Quantum Mechanics. The fusion probability in each channel is approximated by the product of two factors: a tunneling probability and the probability that the system is in that channel when it reaches the strong absorption radius. For sub-barrier energies, the trajectories are calculated through an analytical continuation of the time variable to complex values. In a previous work [2], we have investigated validity of the method in a schematic two-channel application, where the channels in the continuum are represented by a resonant state with width Γ. The agreement between semiclassical and quantal calculations was found to be, which suggested that the procedure might be extended to more sophisticated discretizations of the continuum. In the present work we report on the recent advances in this direction.

References

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