UCRL-JC-125761 Abs

Microscopic Theory of Projectile Breakup and Hauser-Feshbach Modeling

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For reactions involving deuterons, tritons, and alpha particles,... as much as 40% of the reaction cross section is found in the breakup of the projectile. As a consequence 'routine' Hauser-Feshbach model with preequilibrium emissions or multi-step direct reactions is inadequate for calculating outgoing nucleon emission cross sections or spectra. We have developed modeling capabilities by combining Udagawa-Tamura microscopic approach to projectile breakup, Tamura-Udagawa-Lenske theory of multi-step direct reaction, and Hauser-Feshbach model for such reactions. We have also developed a simple phenomenological model using optical potentials to account for the projectile breakup.

We will compare the detailed microscopic calculations with those from the simpler model for the projectile breakup and compare calculated cross sections and particle spectra with several measurements from 10 to 100 MeV. The relative importance of the breakup, direct reaction and Hauser-Feshbach processes will be discussed.

* This work was performed under the auspices of the U.S. Department of Energy at the Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48.

(For oral presentation under 'fundamental nuclear physics' or 'nuclear models, and codes').