Fusion reactions in collisions of neutron halo nuclei with heavy targets

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Introduction

The low binding energy affects elastic scattering and all nuclear reactions.

The influence of low binding energy in fusion reaction

- **Static effect**, the nuclear density of the projectile has a long tail, leading to a lower Coulomb barrier, which is expected to enhance fusion at all collision energies
- **Dynamic effect**,leading to new fusion processes.

  For the usual fusion reaction, the whole projectile is directly absorbed by the target. —DCF(direct complete fusion)

  Due to the strong breakup couplings, the projectile tends to dissociate into fragments as it approaches the target, hindering DCF.
  - If the target absorbs not all fragments-ICF(incomplete fusion).
  - If the target absorbs all fragments sequentially-SCF(sequential complete fusion).

  TF(total fusion) consists of CF(complete fusion-SCF & DCF) and ICF

Introduction

How to investigate the influence of the low binding of the neutron halos?

Study the behavior of the cross section at collision energies below and above the Coulomb barrier using a new method to calculate individual CF and ICF cross sections and compare the results to the available data and the predictions of BPM(barrier penetration model)

- $^{11}\mathrm{Be} + {}^{209}\mathrm{Be}$, $^{6}\mathrm{He} + {}^{209}\mathrm{Be}$, and $^{6}\mathrm{He} + {}^{238}\mathrm{U}$ systems
- **Overview of the calculation method**
  - Evaluate DCF and inclusive capture probabilities through CDCC
  - Obtain CF and ICF cross sections from probabilities through intuitive assumptions based on classical probability theory.