Towards a Realistic Description of Light-ion Fusion Reactions for Astrophysics

G. Hupin[†]

[†]*Lawrence Livermore National Laboratory, P. O. Box 808, L-414, Livermore, California 94551, USA*

The advances in the fundamental description of the interaction between nucleons, scientific computing and many-body techniques have opened new avenues for the modeling of low-energy light-ion reactions. The *ab initio* no-core shell model combined with the resonating-group method (NCSM/RGM) [1] is capable of addressing both structural and reaction properties of light-nuclei. The many-body Hilbert space can be further augmented by coupling the NCSM/RGM binary cluster basis to square-integrable NCSM eigenstates with the no-core shell model with continuum (NCSMC) approach [2]. While promising results have already been achieved starting from a two-body Hamiltonian, a truly realistic prediction of nuclear observables requires the treatment the three-nucleon interactions. Using similarity-renormalization-group evolved two- and three-nucleon interactions [3, 4], we will present the N-^{4}He and d-^{4}He scattering processes when accounting for the chiral two- plus three-nucleon interaction versus the chiral two-nucleon interaction. This work sets the stage for modeling of light-ion fusion reactions with realistic nuclear forces, that are important for understanding nuclear astrophysics processes.[a]

References

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