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An ab initio investigation of 3He+alpha radiative capture

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The 3He(alpha,gamma)7Be radiative capture reaction plays a key role in the creation of elements in stars as well as in the production of solar neutrinos, the observation of which is one of the main tools to study the properties of our sun. Since accurate experimental measurements of this fusion cross section at solar energies are difficult due to the strong Coulomb repulsion between the reactants, the onus falls on theory to provide a robust means for extrapolating from the region where experimental data is available down to the desired astrophysical regime. I will present the first microscopic calculations of 3He(alpha,gamma)7Be with explicit inclusion of three-nucleon forces. Our prediction of the astrophysical S factor qualitatively agrees with experimental data. We further incorporate experimental bound-state and scattering data in our calculation to better understand the origin of the remaining difference. This process reveals that there is insufficient repulsion in the 1/2+ channel of our model space to reproduce elastic-scattering data. This deficit suggests that 3He(alpha,gamma)7Be probes aspects of the nuclear force that are not currently well-constrained.

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