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Progress in ab initio calculations of nuclear reactions

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How collective modes emerge in nuclei, especially in cases where the effects of proximity to the particle continuum are large, remains one of the core problems in nuclear theory. Furthermore, such collective modes have a profound effect on reactions that occur in stellar interiors and nuclear technology applications. Thus, a good description of astrophysical reaction rates needs to properly take into account the clustering (and deformation) aspects of nuclear structure. We will discuss progress in the first-principle description of nuclear reactions, as well as recent applications of the no-core shell model with continuum (NCSMC) to various reactions of astrophysical interest, the description of alpha clustering.

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