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Astrophysical reaction rates from a symmetry-informed first-principles perspective[1] ALISON DREYFUSS, KRISTINA LAUNEY, ROBERT BAKER, JERRY DRAAYER, Louisiana State University, TOMAS DYTRYCH, Nuclear Physics Institute, Czech Republic; Louisiana State University — With a view toward a new unified formalism for studying bound and continuum states in nuclei, to understand stellar nucleosynthesis from a fully *ab initio* perspective, we studied the nature of surface α-clustering in ^{20}Ne by considering the overlap of symplectic states with cluster-like states. We compute the spectroscopic amplitudes and factors, α-decay width, and absolute resonance strength – characterizing major contributions to the astrophysical reaction rate through a low-lying 1^- resonant state in ^{20}Ne. As a next step, we consider a fully microscopic treatment for the n+^{4}He system, based on the successful first-principles No-Core Shell Model/Resonating Group Method (NCSM/RGM) for light nuclei, but with the capability to reach intermediate-mass nuclei. The new model takes advantage of the symmetry-based concept central to the Symmetry-Adapted No-Core Shell Model (SA-NCSM) to reduce computational complexity in physically-informed and methodical way, with sights toward first-principles calculations of rates for important astrophysical reactions, such as the ^{23}Al(p, γ)^{24}Si reaction, believed to have a strong influence on X-ray burst light curves.

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