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ab initio effective operator with continuum

Content

Recent studies of nuclei near driplines have significantly enhanced our understanding of nuclear structure. In the nuclei, the continuum coupling is crucial in reproducing weakly bound and unbound phenomena. To study the observables of the nuclei as open quantum systems, we developed valence-space effective operators in the Berggren basis using many-body perturbation theory. The two- plus three-nucleon force from the chiral effective field theory has been used.
The observed β-decay isospin asymmetry between the dripline nucleus ^{22}Si and its mirror partner ^{22}O is reproduced, highlighting the crucial role of the $s_{1/2}$ continuum. Additionally, continuum effects also play a pivotal role in the significant Thomas-Ehrman shift observed between the mirror daughters ^{22}Al and ^{22}F.
Recent measurements of the $E2$ transition rate from the ground state to the first 2^+ excited state of the proton dripline nucleus ^{36}Ca show an unusual pattern when compared to its isotopic neighbor ^{38}Ca: despite having a higher $E(2_1^+)$ excitation energy, the $B(E2; 0_1^+ \to 2_1^+)$ rate in ^{36}Ca is larger. We found that in the threshold 2^+ state, ^{36}Ca is spatially diffused, which accounts for the abnormal $B(E2)$ trend observed.

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