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ab initio effective operator study dripline nuclei observables

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Recent studies of nuclei near driplines have signifcantly enhanced our understanding of nuclear structure. In those nuclei, the continuum coupling is crucial in reproducing weakly bound and unbound phenomena. To study the observables of the nuclei as open quantum systems self-consistently, we developed valence-space efective operators in the Berggren basis using many-body perturbation theory[1]. The two- plus three-nucleon force from the chiral efective feld 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 efects also play a pivotal role in the signifcant Tomas-Ehrman shift observed between the mirror daughters ^{22}Al and ^{22}F[1].
Recent measurements of the E2 transition rate from the ground state to the frst 2^+ excited state of the proton dripline nucleus ^{36}Ca show an unusual patern when compared to its isotopic neighbor ^{38}Ca: despite having a higher $E(2_1^+)$ excitation energy, the $B(E2; 0_1^+ \rightarrow 2_1^+)$ rate in ^{36}Ca is larger. We found that in the threshold 2^+ state, ^{36}Ca is spatially difused, which accounts for the abnormal $B(E2)$ trend observed[2].

[1] Z. C. Xu, S. Zhang, J. G. Li, et al. Phys. Rev. C 108, L031301 (2023)
[2] Z. C. Xu, S. M. Wang, T. Beck, et al. Phys. Rev. C 112, L011302 (2025)

Research field of your presentation

Theoretical Low-energy nuclear physics

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