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Ab initio resonance and continuum Gamow shell model: applied to calcium isotopes up to beyond dripline

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Based on the realistic nuclear force of the high-precision CD-Bonn potential, we have performed comprehensive calculations for neutron-rich calcium isotopes using the Gamow shell model method (CGSM) which includes resonance and continuum. The GSM calculations well produce the binding energies and single-neutron separation energies of the calcium isotopes, predicting that ^{57}Ca is the last bound odd isotope and even-even ^{70}Ca is the dripline nucleus in calcium chain. Resonant states are predicted, which provides useful information for experiments on particle unstability in neutron-rich calcium isotopes. The evolutions of the shell structure around the neutron numbers of N = 32, 34 and 40 in the calcium chain are understood via the calculations of effective single-particle energies and the energies of the first 2^+ states, as well as two-neutron separation energies. Our calculations support the sub-shell closures in ^{52}Ca (N = 32) and ^{54}Ca (N = 34) and pedict that the N = 40 sub-shell closure disappears in calcium chain. The possible shell closure at N=50 and the dripline position at ^{70}Ca are predicted. Effects from the continuum coupling are discussed.

Abstract Type

Talk

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