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Resonance and Continuum in Atomic Nuclei

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Resonance is a general phenomenon happening in classic or quantum systems. It plays a special role in weakly-bound or unbound quantum systems. An unbound quantum system, such as atomic cluster or unbound nucleus, can emerge in the form of intrinsic resonance. Starting from realistic nuclear forces, we have developed a core Gamow shell model which can describe resonance and continuum properties of loosely-bound or unbound nuclear systems. To describe properly resonance and continuum, the Berggren representation has been employed, which treats bound, resonant and continuum states on equal footing in a complex-momentum plane. To derive the model-space effective interaction from realistic forces, the full Q-box folded-diagram renormalization has been developed for the nondegenerate complex-momentum space. The CD-Bonn potential is softened by using the Vlow-k method. Choosing O-16 as the inert core, we have calculated sd-shell neutron-rich oxygen isotopes, giving good descriptions of both bound and resonant states. The isotopes O-25 and O-26 are calculated to be resonant even in their ground states. Excited-state resonance spectra have been calculated and analyzed systematically for neutron-rich oxygen isotopes, compared with available experimental observations.

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