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Emergent $\mathrm{Sp}(3,\mathbb{R})$ dynamical symmetry from *ab initio* description of the nuclear many-body system

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Abstract

Ab initio nuclear theory provides a predictive and experimentally validated microscopic framework for quantitatively describing the nuclear many-body system, which may now be used as a foundation for obtaining a fundamental understanding of emergent nuclear correlations and collective phenomena. The *ab initio* symplectic no-core configuration interaction (SpNCCI) approach, in which calculations are carried out in an $\mathrm{Sp}(3,\mathbb{R})$ coupled many-body basis, provides a natural framework for investigating approximate symmetries of the nucleus. In this talk we use results obtained in the SpNCCI framework to demonstrate that an $\mathrm{Sp}(3,\mathbb{R}) \supset \mathrm{U}(3)$ symplectic dynamical symmetry provides a near complete qualitative understanding of the low-lying spectrum of $^{7}\mathrm{Be}$, including rotational features. The low-lying states of $^{7}\mathrm{Be}$ form an Elliott $\mathrm{SU}(3)$ spectrum, while $2\hbar\omega$ excitations within an $\mathrm{Sp}(3,\mathbb{R})$ irreducible representation give rise to an excited rotational band with strong quadrupole connections to the ground state band.