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Probing Physics Beyond the Standard Model with *ab initio* Nuclear Theory

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Long considered a phenomenological field, breakthroughs in many-body methods together with our treatment of nuclear and electroweak forces are rapidly transforming modern nuclear theory into a true first-principles, or *ab initio*, discipline. In this talk I will discuss recent advances which expand the scope of such calculations to essentially all properties of light, medium-mass nuclei and beyond. When based on consistently derived two- and three-nucleon forces, this allows first predictions of the limits of nuclear existence and the evolution of magic numbers far from stability. In particular I will focus on recent extensions to fundamental problems in nuclear-weak physics, including a proposed solution of the long-standing quenching puzzle in beta decays, calculations of neutrinoless double-beta decay for determining neutrino masses, and WIMP-nucleus scattering cross sections relevant for dark matter direct detection searches.