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# Ab initio calculations for nuclear astrophysics and searches for new physics

## Content

Breakthroughs in our treatment of nuclear forces constrained by QCD, the many-body problem, and AI/machine learning techniques are transforming modern nuclear theory into a true first-principles discipline. This allows us to now address some of the most exciting questions at the frontiers of nuclear structure, searches for physics beyond the standard model, and connections to nuclear astrophysics

In this talk I will discuss recent advances of the ab initio valence-space in-medium similarity renormalization group and how these breakthroughs have enabled global converged calculations of open-shell nuclei to the 208Pb region and beyond. In particular, I will focus on new results for informing r-process nucleosynthesis simulations in the N=126 region for refining predictions of the third abundance peak. I will then highlight parallel developments driving first ab initio predictions of neutrinoless double-beta decay, WIMP/neutrino-nucleus scattering, abnd symmetry-violating moments, all with quantifiable uncertainties, for essentially all nuclei relevant in searches for new physics.

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