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Constraining Ab Initio Models and the Nuclear Force with Rare Isotopes

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Our Universe has a wide variety of visible matter. An important fundamental question is how nature combines the building blocks, protons and neutrons, to form the large variety of complex many-body nuclei. Addressing this question requires synthesizing observed properties of nuclei and predictions from theoretical models built with knowledge of the nuclear force. A complete understanding of the nuclear force remains a challenge. A major advance in this front has been the description of the nuclear force based on the chiral effective field theory. However, there are different prescriptions of the chiral interactions that need to be constrained with experiments.

Rare isotopes with neutron-proton asymmetry bring in additional sensitivity in defining the force and constraining the models. This presentation will discuss how experimental investigations of static ground state nuclear properties such as masses and radii and dynamic observables such as excitation spectra and diffraction pattern in nuclear scattering have unfolded new understanding of the *ab initio* models, the nuclear forces and exhibited the crucial importance of the three-nucleon force. An outlook on future experimental prospects with rare isotopes will be presented together with the need for *ab initio* theoretical developments.

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