

Unveiling new features in rare isotopes with direct reactions

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Abstract

Rare isotopes with highly asymmetric ratios of protons and neutrons bring new insight into the evolution nuclear structure. The properties of these nuclei approaching the edge of nuclear binding guide our understanding of the state of matter in extreme neutron-rich systems in our Universe. The new features in exotic nuclei challenge our understanding of the nuclear strong interaction which remains a major task to understand from the fundamentals of quantum chromodynamics. Nuclei at the edges of nuclear binding hold promise to be sensitive probes for constraining the nuclear interaction.

The presentation will outline how direct reactions with radioactive ion beams are allowing us to uncover the unknown properties of rare isotopes and leading to revelation of unconventional forms of nuclei such as, nuclear halo and skin structures and fundamental changes of nuclear shells.

The discussion will describe recent experiments using the low-energy re-accelerated beams at TRIUMF exploring Borromean nuclei at the drip-lines. It will be shown how such studies have provided evidences for new resonance states in the Borromean nuclei [1,2]. It will be discussed how the spectroscopic studies have shown strong sensitivity to constrain the nuclear force [3].

Explorations to find and characterize the nuclear skin and halos and associated shell changes from measurements of nuclear radii of light nuclei using intermediate and high-energy beams at the in-flight facilities will be presented as well [4-6].

References

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