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Colinear LRC

The ground-state properties of atomic nuclei reflect the delicate balance between the repulsive force of the Coulomb interaction and the stabilizing force of nuclear interactions, including shell and pairing effects. Some of these properties, such as nuclear spin and electromagnetic moments, are accessible for optical spectroscopy in high-resolution mode. However, many exotic radionuclides of transition metals remain largely uncharted due to their vanishingly low production yields and the inability of conventional ISOL-type facilities to deliver samples rapidly enough for optical spectroscopy. To address these limitations in such studies, we propose combining colinear laser spectroscopy with laser resonance chromatography (LRC), a high-sensitivity technique originally developed for studying superheavy elements. At the DESIR facility, we will implement this approach and integrate it with the LASAGN beamline. The approach will exploit rare isotope beams from SPIRAL1/2 at kinetic energies of at least 30 keV to extract nuclear spins and moments at production rates that are orders of magnitude below conventional thresholds. This will enable the first-time measurement of extremely neutron-deficient, short-lived isotopes, such as ^{41}Ti and ^{47}Mn, establishing a new pathway to better understand nuclear structure in the vicinity of the proton drip line.

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