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Status and Prospects of the RadioActive isotope Measurement Program at SNOLAB (RAMPS)

The RadioActive isotope Measurement Program at SNOLAB (RAMPS) is designed to perform first direct measurement of long-lived nuclear decay processes. The pilot project focuses on performing the first direct measurement of the excited-state electron capture decay of Lutetium-176, a theoretically predicted yet experimentally unobserved nuclear transition. Understanding this highly suppressed transition can provide insight into electroweak interactions which in turn can inform the prediction for the neutrinoless double beta decay searches and advancing theoretical frameworks describing long-lived nuclear processes.

Beyond its fundamental physics objectives, a precise measurement of the excited-state branching ratio will refine the total decay constant of the Lu-176 to Hf-176 system. This will help geochronological applications in dating ancient terrestrial and meteoritic samples. Additionally, improved characterization of this decay channel informs astrophysical models of slow neutron capture (s-process) nucleosynthesis, improving our understanding of heavy element production in giant stars.

RAMPS's experimental setup is deployed 2 kilometre underground at SNOLAB's clean-room facility, providing low background environment. RAMPS employs a triple-coincidence detection method to identify the characteristic excited-state electron capture decay event signature. The system utilizes two high-purity germanium (HPGe) detectors, which provide superior energy resolution for detecting gamma rays from nuclear de-excitation. A silicon photomultiplier (SiPM) coupled with a LuAG crystal scintillator detects the characteristic X-rays produced during atomic de-excitation following electron capture.

In this talk, I will provide an overview of the RAMPS program objectives and the current status of the project, including detector system configuration and characterization as well as analysis methods for identifying rare triple-coincidence events and upcoming data collection timeline.

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