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Modern-day precision mass measurements and the astrophysical r process

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The challenge of identifying the astrophysical site(s) of the rapid neutron capture (r) process, which is responsible for the creation of half of the heavy elements found today, is a multifaceted one which requires input from a gamut of disciplines including observation, theory, and experiment. More experimental data, particularly of nuclear masses, on the neutron-rich side of stability is needed to alleviate uncertainties in current r-process calculations. The Canadian Penning Trap (CPT) mass spectrometer is situated at Argonne National Laboratory in the CARIBU facility where intense beams of neutron-rich nuclei are created from the spontaneous fission of a ^{252}Cf source. To take advantage of the unique beams available at CARIBU, an upgrade to a phase-imaging mass measurement technique (PI-ICR) has been completed at the CPT. This modern technique offers several benefits which cumulatively increase the experimental sensitivity of the CPT, enabling mass measurements of nuclei further from stability than was previously possible. I will describe the implementation of PI-ICR at the CPT and highlight recent mass measurements of rare-earth nuclei near $N = 100$ which may be used to impose constraints on the astrophysical site of the r process.

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