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Mass measurements of neutron-deficient strontium–implications for the rp-process and isospin symmetry

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Precision mass measurements of neutron-deficient fp-shell nuclei near N=Z are of interest to the nuclear physics community because they are relevant to several research areas. First is that these nuclei are situated along the reaction path of the rapid proton capture process (rp-process) which powers type I X-ray bursts. Precision mass values are required for the calculation of astrophysical reaction rates which constrain uncertainty of the mass flow, the burst light curve, and the burst ashes produced. Precision mass measurements in this region are also valued as probes for studying the properties of isospin-symmetry breaking in nuclei via the isobaric mass multiplet equation (IMME). Experimental data on IMME b and c coefficients are used to construct isospin non-conserving shell model Hamiltonians which provide a grounds for investigating isospin non-conserving interactions and also provide a baseline for mass extrapolations. Experimental data presently only enables evaluations of the c coefficients up to the mid-fp-shell at A=60. We report on precision mass measurements of neutron-deficient, upper-fp-shell nuclei $^{74-76}$Sr performed at TRIUMF with TITAN's multi-reflection time-of-flight mass spectrometer. This mass measurement campaign constitutes a first-time direct measurement of ^{74}Sr, a first-time measurement of ^{75}Sr, and improved mass precision of ^{76}Sr. We give preliminary results on the effects that the new mass data have on the rp-process flow, type I X-ray burst ashes, and the IMME b and c coefficients.

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