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Mass Measurements of Actinides at the High-Precision Penning-Trap Mass Spectrometer TRIGA-Trap

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Atomic masses are indispensable in nuclear structure and astrophysics research, and Penning traps enable the most precise mass measurements achievable to date [1]. TRIGA-Trap is a high-precision, double Penning-trap mass spectrometer located in the reactor hall of the TRIGA (Training, Research, Isotopes, General Atomic) research reactor in Mainz, Germany [2]. At TRIGA-Trap, mass measurements of heavy radioactive nuclides particularly actinides are performed with the PI-ICR (Phase-Imaging Ion-Cyclotron Resonance) technique [3]. This method offers high sensitivity, resolving power and accuracy, while requiring relatively short measurement times [3].

Latest mass measurements of actinides, including ^{244}Pu, ^{241}Am, ^{243}Am, ^{248}Cm, and ^{249}Cf have achieved uncertainties at the parts-per-billion (ppb) level and will be included in the next AME (Atomic Mass Evaluation) dataset [4,5]. Precise mass values of actinides are crucial inputs to nucleosynthesis calculations of r-process pathways. In addition, such measurements allow the exploration of nuclear structure through trends in mass filters, such as (two-neutron separation energies) and (average - interaction of the most loosely-bound two nucleons), as well as their differentials [4]. Furthermore, the predictive capabilities of various nuclear shell models for heavy and deformed nuclei can be assessed. Recently, mass measurements in the Pu isotopic chain including ^{238}Pu, ^{239}Pu, ^{240}Pu, and ^{242}Pu have been performed. This will enhance the current dataset and help contribute to ongoing nuclear structure and astrophysical studies.

This poster presentation will provide an overview of the current status of the TRIGA-Trap experiment, highlight recent results, and outline future prospects.

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