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Ion traps for precision experiments at rare-isotope-beam facilities¹

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Ion traps first entered experimental nuclear physics when the ISOLTRAP team demonstrated Penning trap mass spectrometry of radionuclides. From then on, the demand for ion traps has grown at radioactive-ion-beam (RIB) facilities since beams can be tailored for the desired experiment. Ion traps have been deployed for beam preparation, from bunching (thereby allowing time coincidences) to beam purification. Isomerically pure beams needed for nuclear-structure investigations can be prepared for trap-assisted or in-trap decay spectroscopy. The latter permits studies of highly charged ions for stellar evolution, which would be impossible with traditional experimental nuclear-physics methods. Moreover, the textbook-like conditions and advanced ion manipulation – even of a single ion – permit high-precision experiments. Consequently, the most accurate and precise mass measurements are now performed in Penning traps. After a brief introduction to ion trapping, I will focus on examples which showcase the versatility and utility of the technique at RIB facilities. I will demonstrate how this atomic-physics technique has been integrated into nuclear science, accelerator physics, and chemistry.

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