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Multi-reflection time-of-flight mass spectroscopy of superheavy nuclides

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The KEK Wako Nuclear Science Center operates the KEK Isotope Separation System (KISS) which utilizes a small gas stopping cell to produce low-energy beams of multi-nucleon transfer (MNT) products. The group also co-manages, with the RIKEN SLOWRI Team, gas cells and multi-reflection time-of-flight mass spectrographs (MRTOF) at both the end of the ZeroDegree line of BigRIPS and following the GARIS-II recoil separator; a new system is presently under construction for use with the GARIS-III recoil separator. At KISS and the GARIS facilities, one of the primary interests are transuranium nuclides. For understanding both the general physics of superheavy nuclides and the role that fission-recycling of transuranium nuclides has on the astrophysical r-process, measurements of the masses and half-lives of these nuclides would be invaluable. To perform such measurements, which often involve extremely low production yields, we have been developing ion detectors for use with multi-reflection time-of-flight mass spectrographs which allow for ToF-decay correlated measurements. In the case of beta-decay, this technique can suppress signals from stable molecular ions while for alpha-decay it can provide a clear identification of radioactive ions. Both decays allow for the simultaneous determination of atomic mass and decay half-life in a single measurement. The future addition of a capability to measure x-rays and gamma rays will further expand our ability to probe these most exotic of nuclei.

Recent results and future plans for these devices will be presented.

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