

SHARAQ SPECTROMETER: HIGH-RESOLUTION SPECTROSCOPY USING EXOTIC BEAMS AND REACTIONS

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In this talk, we will present the recent developments at SHARAQ in RIBF for high-resolution spectroscopy. The SHARAQ spectrometer has high momentum resolution and satisfies the dispersion-matching condition with the High-Resolution beamline. We are continuously increasing the SHARAQ performance by developments of transport ion-optics and detector systems.

The first point of our development is event-by-event beam tagging with good position and timing resolutions with intense RI beams. Those resolutions are critical for ion-trajectory corrections, and the high-rate capability is an advantage for statistics. We have developed polycrystalline CVD diamond detectors for timing and low-pressure MWDC's for position measurements. The timing resolution of a diamond detector accomplished less than 10 ps(σ), and the position resolution of a LP-MWDC reached less than 100 μm (σ). By using the detectors, we performed TOF-B ρ mass measurement in the vicinity of ⁵⁴Ca and consequently achieved mass resolution (σ_m/m) of 1/9000.

The second point of our development is a coincident multi-particle detection at the spectrometer. The technique was used for the tetra-neutron state study by using the ⁴He(⁸He,⁸Be) reaction and the 0⁻ state studies using the parity-transfer reaction (¹⁶O,¹⁶F[0⁻]). These reactions are so exotic that the cross sections are very small. However, coincident two-particle detection and invariant mass reconstruction using particle trajectories are very effective to identify the reaction events with extremely good signal-to-noise ratio. Finally we successfully obtained clean energy spectra in those reactions against very small statistics.

We will explain details on our technical achievements with performed experiments.