3 - 15 Fast Recoil-Ion Momentum Spectroscopy

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Recoil-ion momentum spectroscopy (RIMS)[1−3] is a very efficient technique to determine the charge state and the momentum vector of a recoiling target ion emerging from collisions between ions and atoms. However, the present RIMS techniques, typically employing gas target, are hard to efficiently obtain physical information of fast recoil ions in violent close collisions.

A Fast Recoil-Ion Momentum Spectroscopy (FRIMS) with a new layout was designed to provide an efficient experimental tool to explore the dynamics of fast recoil ions. The recoiled ions with up to 2 keV energies are expected to be collected. The schematic drawing of the FRIMS is shown in Fig. 1, the whole setup is operated in a high vacuum chamber.

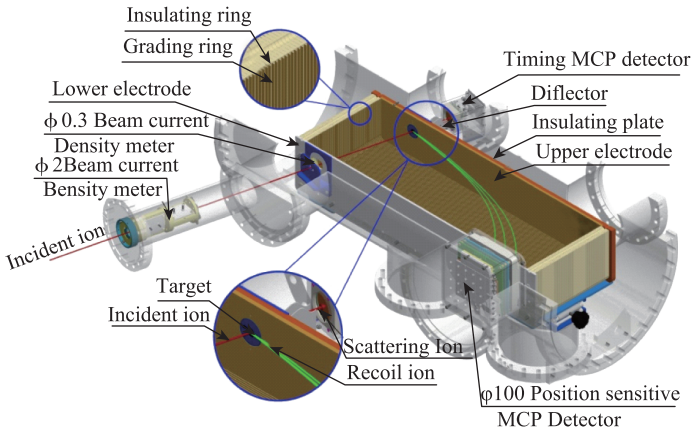

Fig. 1 (color online) Schematic drawing of the FRIMS.

As shown in Fig. 1, the incident ion beam is monitored by a Φ2 mm beam density meter, which also act as a collimator, and steered by two pairs of electrostatic deflectors that oriented perpendicular to each other. Then it is collimated by another beam density meter, and enters the spectrometer. After the collision with the Φ3 mm nano-film target, the incident ions are scattered out the spectrometer. The scattered beam is detected by a timing MCP detector, and give the starting time signal. The recoil ions are deflected to the Φ100 mm position sensitive MCP detector, and then the positions and final time signal can be obtain. The uniform electrostatic field in the spectrometer is provided by the upper electrode plate, the lower electrode plate and the grading ring. Note that, the deflection of the incident beam in the electrostatic field of the spectrometer can be accurately calculated, but it can be ignored in the present case.

Benefited from the new layout, FRIMS is expected to be able to eliminate the huge amount of interference events produced in distant collisions, in which the recoiled ions are of low energies.

References

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