4 - 1 Development of Particle Detectors for Electron-ion Collision Spectroscopy with Highly Charged Ions at the Storage Ring CSRe*

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The electron cooler at the experimental Cooler Storage Ring (CSRe) has been upgraded with an embedded electron energy fast detuning system for the merged-beams electron-ion collision experiments. A plastic scintillation detector (PSD) and a multi-wire proportional chamber (MWPC) detector have been developed and installed downstream of the electron cooler to detect the ionized ions in the electron-ion collision experiments at the CSRe. Both detectors have been tested successfully in a recent dielectronic recombination (DR) experiment of Na-like Kr^{25+} ions at the CSRe. In addition, the measured DR rate coefficients for Kr^{25+} ions from both detectors were compared with the flexible atomic code (FAC) calculations, and a very good agreement is achieved. The present experimental results demonstrate that the new experimental setups at the CSRe including the electron energy fast detuning system and the particle detectors have high stability and efficiency and meet the needs of the forthcoming electron-ion collision precision spectroscopy at the CSRe (Fig. 1).

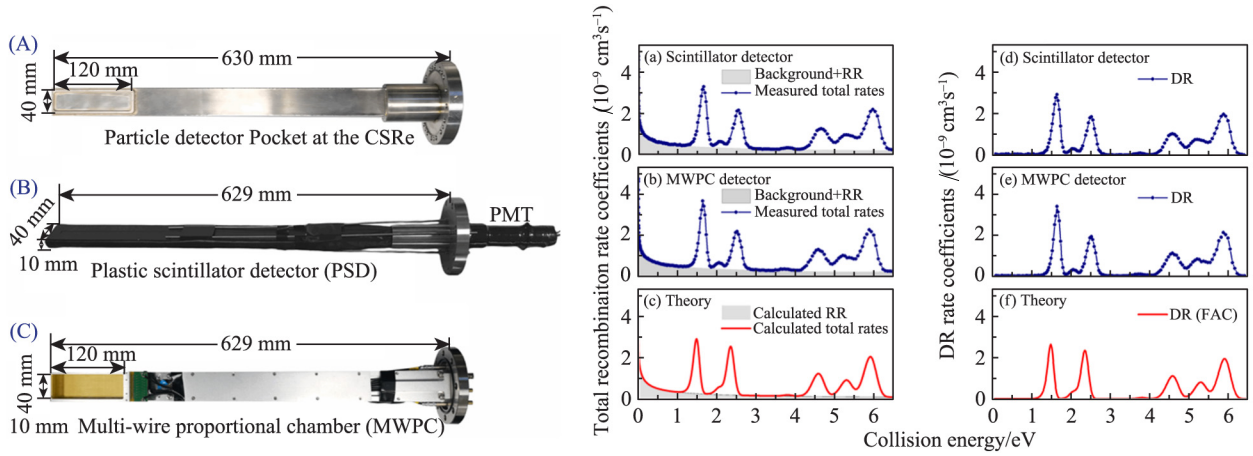

Fig. 1 (color online) The left panel is the photographs of pocket and detectors prepared for the electron-ion collision experiments at the CSRe. Here (A) is the movable rectangular tube-like pockets with a thin stainless-steel window, (B) is the assembled PSD covered with black tape, and (C) is the assembled MWPC detector. The dimensions of pocket and detectors are indicated with black arrows. The right panel are the comparison of merged beams rate coefficients(a∼c) and pure DR rate coefficients(d∼f) for Na-like Kr^{25+} ions at the CSRe. (a) scintillator detector data (dark blue dotted line + light gray color shaded area), (b) MWPC data (dark blue dotted line + light gray color shaded area), (c) theoretical RR (gray color area) + DR (solid red line) rate coefficients, (d) scintillator detector data (dark blue dotted line), (e) MWPC data (dark blue line with the triangle symbol), and (f) theoretical data by FAC calculation (solid red line).

Reference

[1] Z. K. Huang, Nucl. Instrum. Meth. A, 1040(2022)167286.

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