FIRST RESULTS WITH THE KSU MOTRIMS:CHARGE TRANSFER IN Cs^+ + Rb(5s), Rb(5p) and Na^+ + Rb(5s), Rb(5p) LOW ENERGY COLLISIONS*

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For more than a decade, Cold Target Recoil Ion Momentum Spectroscopy (COLTRIMS) has been continually developed and improved, becoming a powerful tool for the study of collision processes[1]. This recent technique allows the simultaneous determination of the final charge state and of the final momentum vector of a recoiling target ion produced in a collision between an atom and any ionizing particle. The information imparted in this vector gives then access to the kinematics of the reaction. The success of COLTRIMS mostly lies in a large detection solid angle (nearly 4π), combined with high resolution in the measurement of the three components of the recoil ion momentum. Nevertheless, this resolution is ultimately limited by the target temperature, and with a traditional target delivered by a supersonic jet, the typical temperature is not better than 100 mK. To further push this temperature limit, several groups have recently developed an apparatus that uses atoms confined in a Magneto-Optical Trap[2] (MOT) instead of a supersonic jet. The resulting cold, localized target is ideal for making measurements using recoil-ion momentum spectroscopy, and the very low temperature of the trapped atoms should significantly improve the resolution[3]. In addition, many alkalis that cannot easily be used in a supersonic jet are particularly easy to trap with a MOT. MOTRIMS thus also increases the variety of the target species previously accessible to COLTRIMS. This new technique has recently been used to perform kinematically complete experiments for charge transfer processes study in Cs^+ + Rb(5s), Rb(5p) and Na^+ + Rb(5s), Rb(5p) low energy collisions. Results from this study will be presented.

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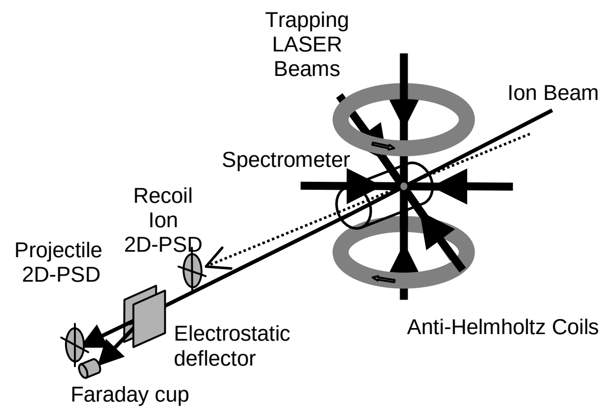

Figure 1. Experimental setup schematic: Six laser beams and a magnetic field produced by anti-Helmotz coils achieve the Rb trapping. Recoil ions resulting from charge transfer are extracted by the spectrometer electric field and detected by a two dimensional position sensitive detector. Downstream, an electrostatic deflector steers the primary beam toward a Faraday cup whereas the neutral projectiles are detected by another two dimensional position sensitive detector. In order to optimize the resolution on the Q value measurement, the recoil ion extraction axis has been chosen quasi parallel to the beam axis.

References

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