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Signatures of the electron saddle swaps mechanism in the photon spectra following charge-exchange collisions

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During the last few years, several experimental and theoretical studies have focused on state selective charge exchange processes between charged ions and alkali metals. These data are of particular importance for the tokamak nuclear fusion reactor program, since diagnostics on the plasma usually rely on charge-exchange spectroscopy. In this sense, alkali metals, have been proposed as potential alternatives to excited hydrogen/deuterium for which laboratory experiments are not feasible at present. In this talk, we present our recent work involving ion collisions with alkali metals. Oscillatory structures in the angular differential charge-exchange cross sections obtained using the MOTRIMS technique are correctly described by classical trajectory Monte Carlo simulations. These oscillations are found to originate from the number of swaps the electron undergoes around the projectile-target potential saddle before capture takes place and are very prominent at impact energies below 10 keV/amu. Moreover, cross sections of higher order of differentiability also indicate that the swaps leave distinctive signatures in the (n,l)-state selective cross sections and in the photon line emission cross sections. Oscillatory structures for the x-ray hardness ratio parameter are also predicted.

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