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Single and double electron capture cross sections in keV-collisions between fully stripped ions with helium atom

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Synopsis We present cross section calculations for single-, double-capture, and double capture to auto-ionizing states occurring in the course of collisions between fully stripped ions A^{q+} ($q \leq 10$) and helium atom at impact energies ranging from 0.25 to 625 keV/u. These calculations were performed by applying a semiclassical non-perturbative close coupling approach, based on the expansion of the scattering wave function into asymptotic bielectronic states with proper translational conditions and including both static and dynamic electronic correlation.

For the four last decades, the semiclassical nonperturbative close coupling formalism has been developed, improved and widely used to describe mainly mono-electronic processes occurring during collisions between atoms and molecules, neutral or charged. Such model has been proved to be reliable and unavoidable for intermediate impact energies, i.e. when the projectile-target relative velocity is of the same order of the (classical) velocity of the active electrons.

The objective of the present work is to apply this approach that has been recently improved to describe *ab initio* the dynamics of up to four electrons of the scattering system [1]. In the conference we shall report cross sections for collisions between He and fully stripped ions of elements of atomic number (Z_p) up to 10 in the 0.25-625 keV/u impact energy domain. We shall especially focus on single capture (SC) and double electron capture (TDC) which are the important ones for the considered energies. The analysis of these processes shows that they strongly depend upon Z_p and are highly final states selective. As an example, for Li^{3+}-He collisions, SC mainly populates n=2 states and our results show good agreement with other theoretical [2] and experimental [3-4] data. Concerning TDC processes which are described for the first time by a true two-electron non perturbative approach we can distinguish true double capture (DC), for which the projectile keeps the two captured electrons, from DC into autonionizing states (AIDC), where the projectile loses one electron. We shall present detailed results concerning the relative contribution of these two processes as function of the projectile charge and impact velocity: for low Z_p DC process is the dominant one while AIDC takes over for increasing Z_p.

Our results for He^{2+}-He and Li^{3+}-He systems are in good agreement with the experimental data [3, 5] but that is not the case for the other systems for which rare results are available.

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