# State-selective electron capture in $C^{4+}$ + He collisions at intermediate impact energies

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**Synopsis** A combined experimental and theoretical study on single capture in 15-50 keV/u $C^{4+}$+He collisions was performed. The experimental state-selective cross sections and angular distributions were in good agreement with the calculations using the two-active electron semiclassical atomic-orbital close-coupling (SCAOCC) method. Further investigation using an extended Fraunhofer-type diffraction model suggests that the oscillatory structures observed in the small-angle scattering come from diffractions of direct (one-step) electron transition processes.

Charge exchange between energetic ions and neutral atoms has attracted much attention for several decades. However, a comprehensive understanding of such kind of few-body process was not feasible. In particular, no decisive conclusion has been obtained regarding the origin of the most interesting structure observed in the projectile scattering angle distribution.

In this work we performed a combined experimental and theoretical investigation on single capture in 15-50 keV/u $C^{4+}$ on He collisions. The experiment was carried out with a reaction microscope at the Institute of Modern Physics, Lanzhou.

The experimental state-selective cross sections are extracted and explicitly shown as a function of impact energy in Figure 1. The SCAOCC results from Gao *et al.* [1] (solid lines in Figure 1) are compared with the present measurements. As it can be seen, the present experimental investigations were extended to higher impact-energy region where the SCAOCC method is expected to be more appropriate. Indeed, the SCAOCC calculations are found to be in excellent agreement with the present measurements in both behavior and magnitude.

In the symposium we shall present angular-differential cross sections (DCS) to investigate in further details the dynamics of these processes. Comparison of our experimental and theoretical results shows good overall agreements, particularly for the oscillatory behaviour that they present. An extended Fraunhofer-type diffraction model suggests that the observed oscillations at small scattering angles stem from the diffraction of probability amplitude patterns of direct (one-step) electron transition processes.

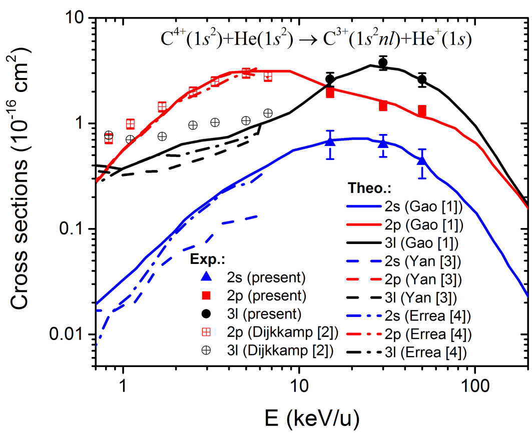


**Figure 1**. The state-selective cross sections as a function of impact energy. Experiments: present measurements (solid symbols) and Dijkkamp *et al.* [2] (crossed symbols); Theories: Gao *et al.* [1] (solid lines); Yan *et al.* [3] (dashed lines); and Errea *et al.* [4] (dot-dashed lines).

## References

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