

4 - 10 Single and Double Electron Capture in He^{2+} -He Collisions

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The He^{2+} -He collision system is the basic homonuclear two-electron ion-atom system that provides the possibility for studying the dynamics of both one- and two-electron collision processes in a most transparent way. It has been, therefore, subject to many theoretical and experimental studies in the past^[1]. In the present work we studied the single electron capture (SEC) and double electron capture (DEC) processes by using the quantum-mechanical molecular-orbital close-coupling (QMOCC) method^[1]. The cross sections for SEC and DEC processes in He^{2+} -He collision are calculated in the energy range of 0.01~17.5 keV/u and $5 \times 10^{-4} \sim 10$ keV/u, respectively. The details of this work can be seen from^[2].

In our calculations, a basis involving 11 *gerade* and 10 *ungerade* molecular states was involved. The molecular wave functions and energies were calculated *ab initio* by the multireference single- and double-excitation configuration interaction (MRD-CI) package^[3]. The present calculations extend the previous theoretical studies^[4, 5] of these processes to much lower energies and are found to be in good agreement with the available experimental results^[6-8] in the overlapping energy range. However, the present QMOCC integral SEC cross sections for energies below 0.4 keV/u show a slower decrease with decreasing the energy than the experimental ones^[6,7]. The discrepancy between the present results with the experimental results of Ref. [7] for $E < 1$ keV/u and of Ref. [6] for $E = 0.3$ keV/u may be due to the inadequate acceptance angle in the experiment in the low energy region, where the large angle scattering should play an important role.

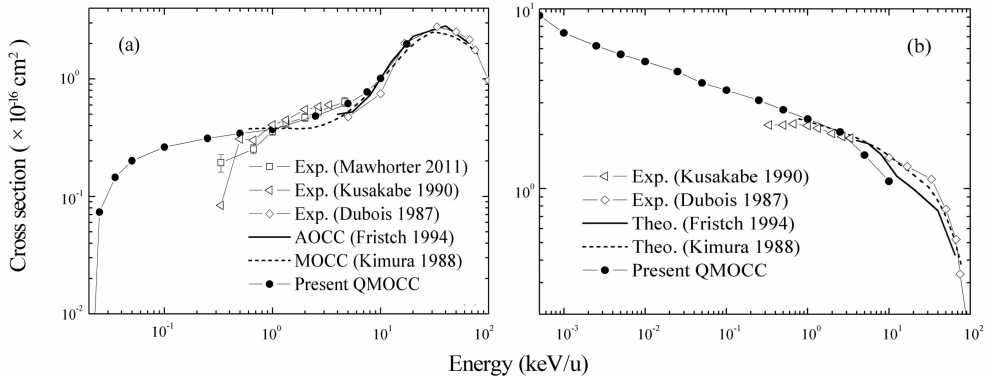


Fig. 1 Cross sections for He^{2+} -He collision. (a) single electron capture; (b) double electron capture.

References

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