

Electron impact excitation of xenon from the metastable state to the levels of $5p^57p$ configuration

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Synopsis Electron impact excitation cross sections from the lowest metastable state $5p^56s$ $J = 2$ to the excited states of the $5p^57p$ configuration of xenon have been investigated. In order to discuss the correlation effects of target states on the cross sections, two models are used to describe target states based on the multi-configuration Dirac-Fock (MCDHF) method. It is found that the electron correlation effects have a large influence on the cross sections and make the cross sections smaller in low energy impact. Good agreement between our results and experimental value has been achieved if more configuration interactions are taken into account.

Metastable states of the noble gases are important constituents of low temperature plasmas. In addition to their long lifetime, these states have large inelastic cross sections compared with excitation from the ground state atoms. Thus, it is important to include these processes in the modeling of plasma discharges for lighting, plasma displays, or gas lasers [1]. Meanwhile, those accurate cross sections are of crucial importance in calculating the width and shift of spectral lines in astrophysics. They are essential for identifying electron impact excited lines in spectra of various astrophysical objects including stars and interstellar gas clouds.

Recently, the first systematic measurements of electron impact cross sections from the $5p^56s$ metastable state with total angular momentum $J = 2$ to the $5p^57p$ levels of xenon have been reported by Jung *et al.* [2]. These reliable experimental data are very useful in lighting and HET modeling [3]. However, to our knowledge, there have been no previous theoretical calculations for these processes. In the present work, we systematically investigated the electron impact excitation cross sections from the metastable states to the excited states of $5p^57p$ levels by use a fully RDW program REIE06 developed by us [4]. The electron correlation effects on the electron impact excitation cross sections are discussed in detail. It is found that the electron correlation effects have a large influence on the cross sections in low energy impact and the agreement between our theoretical results and recent experimental value is good if more configuration interactions are taken into account.

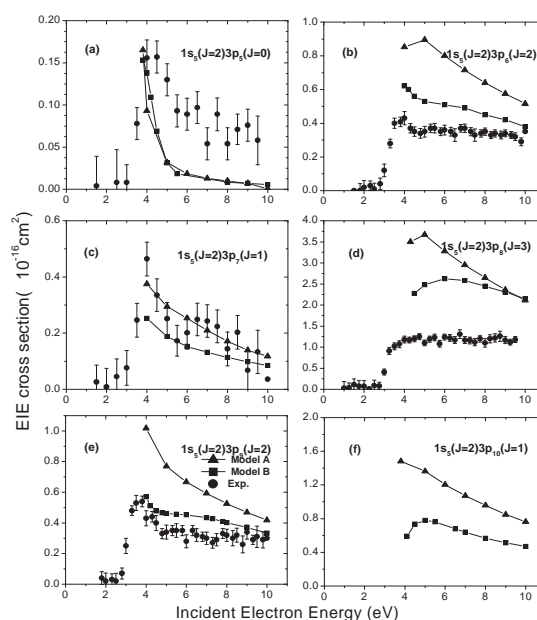


Figure 1. Electron impact excitation cross sections of xenon from the level $1s_5$ to the level $3p_6-3p_{10}$ as a function of incident electron energy. The triangles are the present results in model A, squares are the present results in model B, circles with the error bars are the experiments of Jung *et al.* [2].

References

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