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Fine Structure Effective Collision Strengths for the Electron Impact Excitation of Ca VI

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Ca VI emission lines arising from transitions among the $3s^23p^3$ levels of lowly ionized ions of the phosphorus isoelectronic sequence have been widely detected in the optical and near-infrared spectra of planetary nebulae (see, for example, Hyung & Aller [1-4]. In principle, these transitions provide excellent density and/or temperature diagnostics for the emitting plasma (Czyzak, Keyes & Aller [5]; Stranghellini & Kaler [6]). These observational data require accurate atomic data in the form of electron impact excitation rates (effective collision strengths) for analysis and interpretation. However, for this ion there are currently no such data available in the literature. To address this gap in the literature, we have therefore carried out a sophisticated *R*-matrix calculation.

An 18-state calculation has been performed. The target states are represented by configuration interaction wavefunctions and consist of the 18 lowest *LS* states, having configurations $3s^23p^3$, $3s3p^4$ and $3s^23p^23d$. These target states give rise to 39 fine structure levels and 741 possible transitions. The fine structure collision strengths were obtained by transforming to a jj-coupling scheme using the JAJOM program of Saraph and have been determined at a sufficiently fine energy mesh to delineate properly the resonance structure. The effective collision strengths are calculated by averaging the electron collision strengths over a Maxwellian distribution of velocities. The non-zero effective collision strengths for transitions between the fine structure levels are given for electron temperatures (T_e) in the range $\log_{10} T_e(\mathrm{K}) = 4.5 - 6.5$. Data for transitions among the 5 fine structure levels arising from the $3s^23p^3$ ground state configurations will be presented. These calculations are the first evaluations of collision strengths and effective collision strengths for this ion.

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