Electron-impact excitation data for modeling polarized line emissions from the solar atmosphere

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Analysis of the polarized line emission from hot plasmas requires knowledge of the multipole rate coefficients for collisional excitation of highly charged ions by electrons in the isotropic or cylindrical symmetry conditions. For isotropic electrons, these collision data are involved in lines formed by photoexcitation due to an external anisotropic radiation, in addition to excitation by local isotropic thermal electrons. This scenario can occur in line emission from the solar corona irradiated anisotropically by the photosphere. In the case of electrons with a cylindrically symmetric velocity distribution, the multipole rate coefficients are needed for plasmas such as those found in solar flares and active regions where beams of energetic electrons may be generated. Relatively little attention has been paid to the multipole rate coefficients. We previously reported their calculations for isotropic collisions considering transitions in the Fe XIII ion, assuming a Maxwellian electron distribution [1]. These calculations are useful in analyzing the coronal lines at 1074.7 and 1079.8 nm. More recently, we provided results of the multipole rate coefficients for excitation of the O V ion from its metastable 2s2p triplet levels, using an anisotropic Maxwellian distribution with two temperatures along the parallel and perpendicular directions to the symmetry axis [2]. Such results may be relevant to active regions. In this communication, we present some data to illustrate how the excitation program used to compute the multipole collision strengths [3] opens new prospects for the field of solar polarization spectroscopy. References [1] A. F. Sekkal-Haddouche, M. K. Inal and M. Benmouna, Eur. Phys. J. D 77, 148 (2023). [2] A. F. Sekkal-Haddouche, M. K. Inal and M. Benmouna, Phys. Rev. A 111, 042814 (2025). [3] M. Belabbas, M. K. Inal and M. Benmouna, Phys. Rev. A 104, 042818 (2021).