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The CO Cameron bands in the Mars dayglow and aurora:consequences of revised cross sections

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The spin-forbidden CO a $^3\Pi$-> X $^1\Sigma$ Cameron bands (190-270 nm) are the dominant feature of the middle ultraviolet spectrum of the Martian dayglow and aurora. Since their discovery in the Mars dayglow during the Mariner era (Barth, 1969), a number of studies based on observations with the SPICAM instrument on board the Mars Express (Leblanc et al., 2006; Cox et al., 2010; González□Galindo et al., 2018) and IUVS/MAVEN (Jain et al., 2015) have revealed their altitude distribution and seasonal changes (Gérard et al., 2019). The Cameron bands are also an important marker of the distribution of auroral events on the nightside aurora, together with the CO_2^+ ultraviolet doublet at 288-289 nm (Gérard et al., 2015; Schneider et al., 2015). One of the important processes producing the metastable a $^3\Pi$ upper state of the transition is dissociative excitation of CO_2 by impact of photoelectrons or auroral electrons:

e (E> 11.5 eV) + CO_2 à CO (a $^3\Pi$) + O + e

The excitation process includes cascades from higher lying states, which makes *ab initio* calculations quite complex.

Until recently, models for the production of the Cameron bands used the energy dependence of the cross section initially published by Ajello (1971) 50 years ago. It was later normalized by Avakyan et al. (1999) to the value of Erdman and Zipf (1983) at 80 eV. The absolute value of the cross section was later scaled by different factors to account for revisions of the radiative lifetime of the a$^3\Pi$ state and match the observations. Recently, a new set of measurements in a large laboratory facility attenuating the wall effects has led to a revision of both the shape and the peak value of this cross section (Lee et al., 2021a).

In this presentation, we assess the consequences of this revision on the production of the Cameron bands in the Martian airglow and aurora. In particular, we discuss the importance of the contribution of the excitation of CO by electron impact e (E> 6 eV) + CO -> CO(a 3Π) + e, also recently re-examined by Lee et al. (2021b). We discuss the relative importance of the two processes and its dependence on the CO mixing ratio in the Mars thermosphere. We also examine how these new values may affect the anomalies in the Cameron/CO2+ UV doublet intensity ratio observed with IUVS in the discrete aurora (Soret et al., 2021).

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