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Electron impact excitation data for modeling planetary atmospheres and cometary comae

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Measurements were undertaken of electron impact cross sections for vibrational and electronic excitation of NO. Incorporation of these in models showed that electron impact excitation produced a proportion of the (1→0) emissions near 5.3 μm in aurora. A study of the role of electronically excited N_2 in the production of nitric oxide, using new compilations of the relevant cross sections, showed that electron-impact excitation is significant. A compilation of recent experimental and theoretical cross sections for electron impact excitation of vibrational modes in CO_2 was undertaken and applied in an updated calculation of electron cooling rates in the atmosphere of Mars. These rates were found to be substantially larger in the very cold part of the Martian upper atmosphere, giving a possible explanation for why that region was measured to be colder than expected from modeling. Recent theoretical cross sections for electron-impact excitation of the A $^1\Pi$ state of CO were shown to be consistent with recent laboratory measurements. They were then applied in a simulation of the Fourth Positive emissions from CO in comet Hale-Bopp. It was found that the electron-impact excitation component is substantial, with implications for one estimate of the abundance of CO in the comet.

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