THE HIGH-RESOLUTION EXTREME-ULTRAVIOLET SPECTRUM OF $N_2$ BY ELECTRON IMPACT

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We have recorded high-resolution (FWHM = 0.2 Å) extreme-ultraviolet (EUV, 800–1350 Å) laboratory emission spectra of molecular nitrogen excited by 20 and 100 eV electron impact under mostly optically thin conditions. From these, emission cross sections were determined for a total of 491 features arising from $N_2$ electronic-vibrational transitions and atomic $N$ I and $N$ II multiplets. Molecular emission was observed from those excited levels which are not completely predissociative and to ground-state vibrational levels as high as $v = 17$.

The frequently-blended molecular emission bands were disentangled with the aid of a coupled-channels model of excited $N_2$ states that includes the strong coupling between valence and Rydberg electronic states and the effects of predissociation. The observed emission bands probe a large range of vibrational motion so that internuclear-distance-dependent electronic transition moments could be deduced experimental. The coupled-channels model could then be used to predict the emission cross sections of unobserved bands and those that are optically thick in the experimental spectra.

The electron-impact-induced fluorescence measurements and model were compared with Cassini UVIS observations of emissions from Titan’s upper atmosphere.

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