

Abstract for an Invited Paper
for the DAMOP11 Meeting of
The American Physical Society

Electron-Nitrogen Collision Processes Relevant to Planetary Atmospheres¹

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Electron-N₂ collisions play an important role in the nitrogen-rich upper atmospheres of Titan, Triton, and Earth. Modeling these processes requires accurate laboratory data. Despite the recognized importance of such data, there remained an unsatisfactory degree of consensus among much of the available laboratory collision cross section data. To address this situation, our group has devoted considerable effort over the past decade to improve the status of low energy electron collision data. In doing so, we have measured direct excitation cross sections for at least 17 electronic states of neutral N₂ and a variety of key UV emission cross sections. Here we review the result of this effort, highlighting how the picture of electron collision processes has evolved, where consensus has been reached and where discrepancies still exist. New electron energy-loss measurements will be presented for excitation of the valence states, with finely spaced (<1eV) impact energy increments in the threshold-to-peak region where excitation is not in proportion to the Franck-Condon factors. These data are novel in that they include measurements at fixed electron scattering angles, differential in impact energy over a range of scattering angle. Also, new near-threshold integral cross sections are provided and compared to existing data.

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