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Low energy electron collision parameters for modeling auroral/dayglow phenomena[1]

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From the tenuous atmospheres of Pluto and Triton to the higher pressure atmospheres of Earth and Titan, electron-collisions with molecular nitrogen continue to warrant attention. The airglow emissions of N_2 from the atmospheres of Earth and planetary satellites have been extensively observed. Accurate, consistent cross section data is a necessity for accurate models of how upper atmospheres behave. This enables determinations of solar energy inputs and atmospheric expansion and contraction, which influences satellite orbits for instance. Recent work by Lean *et al.* [1], Stevens *et al.* [2], and Kato *et al.* [3] appear to substantiate our e^-+N_2 excitation and emission work (e.g., Johnson *et al.* [4], Malone *et al.* [5], Young *et al.* [6] and references therein). Recently, we have focused on the near-threshold-to-peak region of N_2 with the goal of providing low energy collision parameters of the $X^1\Sigma_g^+(0)$–$A^3\Sigma_u^+$, $B^3\Pi_g$, $W^3\Delta_u$, $B'^3\Sigma_u^-$, $a'^1\Sigma_u^-$, $a^1\Pi_g$, $w^1\Delta_u$, $C^3\Pi_u$, and $E^3\Sigma_g^+$ transitions for modeling auroral and dayglow phenomena in these N_2-rich atmospheres. The Lyman-Birge-Hopfield (LBH) emissions, from $a^1\Pi_g(v')$–$X^1\Sigma_g^+(v'')$ transitions, are 'bellwether' measurements for diurnal Terrestrial Space Weather variations [7]. However, near-threshold cross section data is still lacking for the $a^1\Pi_g$ state, as well as the '*slow-cascade*' $a'^1\Sigma_u^-$ and $w^1\Delta_u$ contributors to LBH emissions. In addition, Vegard-Kaplan (VK) emissions, from the $A^3\Sigma_u^+(v')$–$X^1\Sigma_g^+(v'')$ transitions, recently observed in Titan's thermosphere [2], require further improved monoenergetic laboratory measurements. New electron energy-loss measurements, along with direct excitation (integral) cross sections, are presented for excitation of the lower states of N_2, with finely-spaced impact energy increments in the threshold-to-peak region. Our recent work, including vibrationally resolved excitation, addresses these atmospheric data needs.

[1] Lean *et al.*, 2011, JGR, 116, A01102.
[2] Stevens *et al.*, 2011, JGR, 116, A05304.
[3] Kato *et al.*, 2010, PRA, 81, 042717.
[4] Johnson *et al.*, 2005, JGR, 110, A11311.
[5] Malone *et al.*, 2009, J. Phys. B, 42, 135201.
[6] Young *et al.*, 2010, J. Phys. B, 43, 135201.
[7] Ajello *et al.*, 2011, UV Molecular Spectroscopy from Electron Impact for Applications to Planetary Atmospheres and Astrophysics, Book Chapter 28, published in "Charged Particle and Photon Interactions with Matter" Recent Advances, Applications, and Interfaces-Eds., Hatano *et al.*, Taylor & Francis, Boca Raton, FL.

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