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Suprathermal electron spectra in the Venus ionosphere

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In this study, a multi-stream kinetic model is used to derive the suprathermal electron intensity in the Venus ionosphere, to be compared with the observations made by the ASPERA-4 ELS instrument onboard VEx on 18 May 2006 (Coates et al. 2008). We consider two cases for the magnetic field line configuration. The first assumes vertical magnetic field lines, while in the second the configuration is consistent with the VEx MAG measurements for that particular orbit. The model calculations suggest that the energy spectrum of suprathermal electrons not only depends on the local photoelectron production, but is also strongly influenced by transport as well as energy degradation. We confirm the postulation of Coates et al. (2008) that the spectral features seen in the ASPERA-4 ELS data are signatures of O+ production by solar HeII 30.4nm photons at altitudes where vertical transport is important. The model results indicate that the condition of local equilibrium is satisfied for suprathermal electrons below $\sim$155km on Venus. However, transport becomes effective at higher altitudes, significantly altering the secondary electron production rate and leading to strongly anisotropic suprathermal electron flow. For the case with the MAG-derived, slanted magnetic field configuration, we make a data-model comparison in terms of both the absolute magnitude of the suprathermal electron intensity and the appearance of spectral peaks. The comparison suggests that the actual magnetic field lines are probably inclined more vertically than a simple extrapolation from the MAG measurements.