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Auroral Processes Observed by e-POP

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Data recorded simultaneously by different instruments on the payload of the Enhanced Polar Outflow Probe (e-POP) provide evidence about the relationships of ionospheric processes. Launched in September 2013 on the Canadian small satellite CASSIOPE into low-earth orbit, the e-POP ensemble has been able to exploit novel ionospheric perspectives. The understanding of auroral-latitude physics is advancing thanks to movies of auroral luminosity below the spacecraft recorded by the e-POP Fast Auroral Imager (FAI) that provide a setting for processes detected by other e-POP instruments. By producing one image per second of near-infrared (NIR) emissions at a heights near 110 km, the FAI contributes to a knowledge of what is happening in the three-dimensional space surrounding the magnetic field line through the spacecraft.

FAI measurements have been compared with radio observations by the e-POP Radio Receiver Instrument (RRI). Both kinds of emissions are excited by free energy available from nonequilibrium electron distributions. Understanding these processes monitored simultaneously at both wavelengths may help to improve models of energy input to the ionosphere. Very-low-frequency (VLF) hiss recorded in the neighbourhood of pulsating aurora lends credibility to the agency of electron precipitation that is sufficiently energetic (10-100 keV) to create whistler-mode propagation with wave-vectors aligned predominantly close to the axis of the terrestrial magnetic field. With such particle energies, parallel-propagating electromagnetic whistler-mode waves can be created throughout their observed band-width on the RRI. Such RRI spectrograms contrast with those supplying evidence of oblique quasi-electrostatic whistler-mode propagation of auroral hiss.
In e-POP crossings of auroral arcs, contemporaneous measurements from FAI and RRI confirm that stable NIR auroral arcs locate the spectrographic vertex of V-shaped VLF hiss emission. We intend to evaluate concepts proposed for the structure and dynamics of auroral-latitude phenomena by recourse to data from various other e-POP and ground instruments

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