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Aurora-Associated Phenomena and the ePOP Mission

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Enhanced polar outflow probe (ePOP) is a scientific part of a Canadian Space Environment Satellite to be launched in the first quarter of 2007. The mission aims to study plasma and atmospheric neutral outflows in the topside polar ionosphere (300-1500 km altitude), the wave generation and particle interaction associated with these outflows and their effects on radio wave propagation.

A frequently-observed type of ion outflow occurs over auroral arcs and is accompanied by a strong electron temperature increase and unchanged or almost unchanged ion temperature. Three important findings in [1] constitute a significant progress in understanding this phenomenon: (1) a conclusion that a field-aligned electric field is indeed responsible for the observed electron temperature increases based on the investigation of the electron energy balance (a key element to the solution of the problem); (2) pinning down the origin of the field-aligned electric field confirmed by reanalysis of observations; (3) hypothesis that the presence of high-frequency turbulence slows the electrons down, which in turn enhances the ion motion. The current densities reach values of the order of 50 $\mu A/m^2$ in the process.

When compared to the energy involved in natural auroral phenomena, reaching sometimes more than 100s of eV, the power input into the ionosphere from groundbased powerful radio transmitters is much more modest, not exceeding 10 or possibly 20 eV at the greatest. Even so, by transmitting powerful radio waves into the ionosphere it is possible to reproduce some of the natural auroral phenomena, for example generation of artificial aurora [2], Alfven waves [3] and ion outflow [4] from the auroral F region accompanied by a strong electron (but not ion) temperature increase. The ePOP mission will enrich the data base of both natural and artificial aurora-associated phenomena.

References

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