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Using simulations to understand dynamic auroral acceleration

C. Watt, R. Rankin, I.J. Rae

Department of Physics, University of Alberta, Edmonton, Canada (apache@space.ualberta.ca)

The aurora is the end result of a multitude of physical processes that are occurring in the near-Earth environment. Rarely are two auroral displays the same; on occasions, aurora may remain static and fill the sky for many minutes, while in other cases the aurora will dance, pulsate, and sweep across the sky in a matter of seconds. The general physics of this highly complex and variable system are broadly understood. However, the dynamics of many of the processes which result in moving or flickering auroral displays are not so well understood. What is certain is that the electrons that produce these displays are accelerated above the Earth's atmosphere, and in this talk we discuss one possible time-varying mechanism to accelerate these electrons. Using a self-consistent drift-kinetic plasma simulation code, we show that electrons accelerated by shear Alfvén waves (electromagnetic waves which propagate along the geomagnetic field) can easily provide an explanation for the observed accelerated electron population. In this talk we illustrate the use of computer simulations to help guide the interpretation of satellite and rocket data by demonstrating the possible history of the accelerated electrons. By varying the physical properties of the Alfvénic perturbation (e.g. amplitude, perpendicular scale length etc), we can gain further physical insight into this acceleration process.