

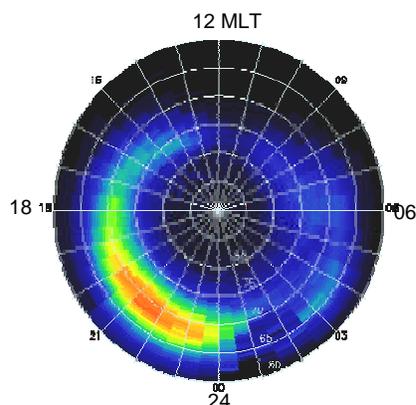
Title: *Diurnal and Seasonal Control of Auroral Precipitation*  
 Cluster: *Cross-Theme Theory and Data Analysis/SECTP*  
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## • Quantitative modeling of multi-banded, discrete auroral arcs

Discrete auroral arcs are most prevalent in the pre-midnight winter ionosphere and often appear as multi-banded structures that intensify, drift, and then fade. Recent advances in the theoretical modeling of active ionospheric dynamics, with southern and northern hemispheres electrodynamically coupled along geomagnetic flux tubes, provide an explanation for the arc behavior. Horizontally drifting ionospheric density fluctuations, driven by convection electric fields of magnetospheric origin, stimulate geomagnetic field line oscillations. These growing oscillations produce low-frequency turbulence in the magnetic field-aligned electrical current near  $1 R_E$  altitude. The effective impedance gives rise to an electric potential drop along the field line, which ignites an auroral arc by boosting precipitating magnetospheric electrons to kilovolt energies. The seasonal dependence of arc formation is a consequence of the seasonal variation in ionospheric density. The observed arc motions are due to the finite propagation time of the field line oscillations extending between hemispheres.

Physical models of the interaction between the magnetosphere and ionosphere are essential for assessing energy flow through the Sun-Earth system and for interpreting satellite and ground-based images of magnetospheric dynamics. Understanding the coupling between global magnetospheric scales and small-scale ionospheric structures allows us to successfully plan and execute Solar Terrestrial Probe spacecraft missions designed to explore scale-interactive processes in global electrodynamic coupling.

### OBSERVATIONS

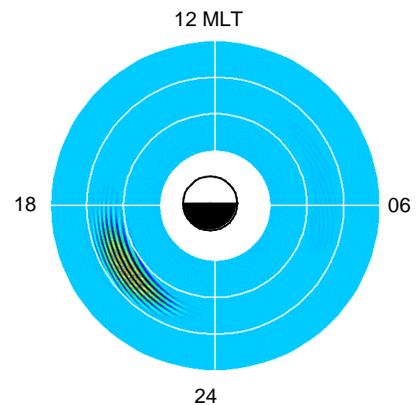


*Statistical Distribution  
of Auroral Arcs  
Around Pole*



*Discrete Arcs:  
Multibanded  
and Drifting*

### MODEL



*Winter Hemisphere:  
Multibanded, Drifting  
Discrete Auroral Arcs*

Reference: "Effects of the seasonal asymmetry in ionospheric conductance on the formation of discrete aurora," D. Pokhotelov, W. Lotko, and A.V. Streltsov, *Trans. Am. Geophys. Union* 81, F1018, 2000.