BOSTON UNIVERSITY

Boston University College of Arts & Sciences
Center for Space Physics

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It's Not Easy Being Green: Quantitative Modeling of Aurora-like Picket Fence Emissions Driven by Local Ionospheric Parallel Electric Fields

The 'picket fence' is a captivating visual phenomenon characterized by vibrant green streaks in the subauroral sky, often appearing below a rare purpleish-white arc called STEVE (Strong Thermal Emission Velocity Enhancement). Recent studies suggest that, despite its aurora-like appearance, the picket fence may be driven NOT by magnetospheric particle precipitation but instead by local ionospheric electric fields parallel to Earth's magnetic field. We investigated this hypothesis by quantitatively comparing observed picket fence spectra with emissions generated in a kinetic model driven by parallel electric fields in a realistic neutral atmosphere. We find that sufficiently large parallel electric fields can reproduce the observed ratio of N2 first positive to oxygen green line emissions, without producing N2+ first negative emissions, reproducing the unique emission spectrum of the picket fence. At a typical picket fence altitude of 110 km, parallel electric fields between 40 and 70 Td (~80 to 150 mV/m at 110 km) result in calculated spectral features consistent with observed ones, providing a benchmark for future observational and modeling studies. Additionally, we review studies which have identified similar features to the picket fence in the aurora, suggesting that a similar mechanism may be at work there. Since visible and ultraviolet auroral emissions are increasingly used to infer magnetospheric activity, it is important to better understand and quantify potential sources of emission beyond particle precipitation. Furthermore, this work highlights how, when combined with modeling, detailed spectroscopic observations prove a powerful tool for diagnosing and disentangling new ionospheric physical processes.

Thursday, October 10th

3:30 - 4:30 p.m.

725 Commonwealth Ave | Room 502

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Background Photo by Robert Downie