Multi-wavelength imaging observations of STEVE at Athabasca, Canada

*Sneha Yadav[1,2], Kazuo Shiokawa[1], Yuichi Otsuka[1], Martin G Connors[3], Jean-Pierre St. Maurice[4,5]

1. Institute for Space-Earth Environmental Research, 2. Space Physics Laboratory, Vikram Sarabhai Space Centre, Trivandrum, India, 3. Athabasca University Observatories, Athabasca University, Athabasca, Alberta, Canada, 4. Department of Physics and Engineering Physics, University of Saskatchewan, Saskatoon, Saskatchewan, Canada, 5. Department of Physics and Astronomy, University of Western Ontario, London, Ontario, Canada

STEVE (Strong Thermal Emission Velocity Enhancement) is a relatively new phenomenon in the area of auroral physics. Although STEVE has been recognized by amateur night sky watchers for about a decade, it is only recently that it has drawn attention of the space physics community. STEVE is distinctly different from traditional aurora and appears as a violet and green narrow band structure spreading over thousands of kilometers in the east-west direction. The purple STEVE emission is also accompanied usually by "Picket Fence" structure which are the distinct structures of green color. In this paper, we present the first multi-wavelength observations of STEVE using an all-sky imager at Athabasca (magnetic latitude = 61.7°N), Canada. This study is based on three STEVE events which were accompanied by picket fence structures in the green-line. Although the STEVE arc was dominant in 630.0 nm, weak emissions were also found in other wavelengths including OI at 844.6 nm, Hβ, and background continuum emission at 572.5 nm. The investigation on the evolutionary characteristics of the STEVE arc in 630.0 nm reveal that it detached from the auroral oval as a faint structure and moved equatorward. Similar to the arc in 630.0 nm, the arc in the 557.7 nm also detached from the auroral oval. In addition the 557.7 arc exhibited picket fence structure at later times. The picket fence was sometimes found to persist even after the 630.0 nm arc had disappeared. Based on the horizontal component of the geomagnetic field at Fort Smith (magnetic latitude 67.28°N), we find that the STEVE arc detachment, its equatorward motion, and its brightness coincided with additional magnetic activity in the recovery phase of a substorm. One of the distinctive features of our results is the appearance of dark bands at the poleward edge of the 557.7 nm arc. These dark bands might represent the so-called "black aurora". These results indicate that STEVE is not a sole consequence of F-region heating, but particle precipitation from the inner magnetosphere and associated field-aligned currents might play an important role to trigger STEVE.

Keywords: STEVE, Airglow, Aurora, subauroral ionosphere

