

Auroral fragmentation into patches and pressure balance condition in the source magnetosphere

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The auroral fragmentation into patches has been reported by Shiokawa et al. (JGR, 2010; 2014) as finger-like structures developed in the diffuse aurora with horizontal scale sizes of 5-25 km (small scale) and 40-100 km (large scale). The development of these finger-like structures divides the diffuse aurora into patches. Thus we call it as the auroral fragmentation which is a cause of the patchy auroral structures in the diffuse aurora. Hashimoto et al. (JGR, 2015) made a statistical analysis of these auroral finger-like structures and found their occurrence rates of 13% and 4 % for large- and small-scale events, respectively. They also indicated that the finger-like structures tend to occur at the beginning of the substorm recovery phase in the post-midnight and dawn sectors. The auroral finger-like structure suggests the development of pressure-driven instability in the magnetosphere. Recently Nishi et al. (JGR, 2017) made the first conjugate measurement of the auroral finger-like structures with the THEMIS-E satellite at ~8 Re in the magnetosphere. They found clear anti-phase oscillations between the magnetic and plasma pressures in the post-midnight plasma sheet. This anti-phase variation is consistent with the idea of the pressure-driven instability. On the other hand, Nishi et al. (JGR, 2018a) reported that a conjugate event with the RBSP-A satellite at ~5.5 Re does not show systematic phase relationship between the magnetic and plasma pressures. Then Nishi et al. (JGR, 2018b) investigate statistical features of the phase relationship between magnetic and plasma pressures using two-year THEMIS-E observations in the nightside plasma sheet and obtained a high occurrence of the anti-phase oscillations between the magnetic and plasma pressures. In the presentation, we will review these recent results on the auroral fragmentation and pressure balance condition in the source magnetosphere, and discuss possible physical mechanism that contributes these phenomena.

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