A tool to diagnose magnetosphere under northward IMF conditions: Simultaneous detections of TPA and omega-band aurora

*Motoharu Nowada[1]

1. Shandong Provincial Key Laboratory of Optical Astronomy and Solar-Terrestrial Environment, Institute of Space Sciences, Shandong University, Weihai

In this study, we try to explore the feasibility on whether or not the magnetospheric processes under northward Interplanetary Magnetic Field (IMF) conditions can be diagnosed using two different auroral phenomena; transpolar arc (TPA) and omega-band aurora. Both TPA and omega-band aurora can occur during the northward IMF intervals, and their appearances are closely related with the nightside magnetospheric processes. TPA can be formed and grown by the field-aligned currents induced by the plasma flow shear or the plasm vortex structures between the fast plasma flows generated by magnetotail magnetic reconnection and slower background magnetospheric flows, and the convection of the reconnection-formed closed magnetic fluxes, which cause in the nightside plasma sheet. On the other hand, the omega-band aurora can be attributed to the Kelvin-Helmholtz instabilities triggered by the flow shear between the plasma flows of the nightside magnetospheric boundary layer such as low-latitude boundary layer (LLBL) and background magnetospheric (plasma sheet) flows. If both auroral phenomena can simultaneously be observed, we might remotely investigate (diagnose) how the plasma and its energy are transported in the nightside magnetosphere and at the magnetospheric boundary region under northward IMF conditions. We will discuss the feasibility of this magnetospheric diagnosis, giving the observational example(s) of simultaneous observations of two different auroral phenomena, that is, TPA and omega-band aurora, and in-situ magnetospheric observation(s).

Keywords: Transpolar arc and omega band aurora, Solar wind-magnetotail-ionosphere coupling , Magnetospheric diagnosis, Magnetospheric dynamics under northward IMF conditions

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