

Evolution of plasma sheet-like region in the polar magnetosphere: Cluster observation

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Theta aurora is a sun-aligned aurora sometimes observed in the polar cap. A global image of theta aurora was first observed by DE-1 in 1980s, and subsequently by the AKEBONO and POLAR satellites.

An MHD simulation suggests that the theta aurora is generated by the plasma sheet divided into two parts and penetrating into the lobe region, the so-called bifurcated plasma sheet. According to this model, theta aurora appears and moves in the dawn-dusk direction, when the IMF B_y changes its sign during an extended northward IMF. Simultaneous ACE satellite observations indeed show consistent results.

However, there are few observations of particle fluxes in the polar cap that is believed to be the source of the theta aurora. The AKEBONO and POLAR satellites made such observations, but we still lack enough measurements in regions corresponding to the bifurcated plasma sheet. Especially, there were no simultaneous multipoint observations in the polar magnetosphere that enable us to investigate the special structure and temporal development of plasma sheet-like regions, and thus the above model had not been tested from the magnetospheric point of view.

In the present study, therefore, we inspect the validity of the generation model of the theta aurora on the basis of observations of the polar cap particle fluxes by Cluster.

First, since the formation-flying satellites Cluster can resolve the special structure and temporal development of the region of enhanced particle fluxes, we analyze how the plasma sheet-like regions in the polar cap move and temporally evolve. The results are then compared with those expected from the MHD simulation, in order to test the model. In addition, we will discuss the validity of the model, taking into account the characteristics of the ionospheric convection observed by SuperDARN, and of aurora images taken by the POLAR and IMAGE satellites.