Complex and fast motion of the afterglow of aurora

*Herbert Akihito Uchida[1,2], Ryuho Kataoka[2,1], Yoko Fukuda[3], Yoshizumi Miyoshi[4], Yusuke Ebihara[5], Donald Hampton[6], Michael Nicolls[7]

1.SOKENDAI (The Graduate University for Advanced Studies), 2.National Institute of Polar Research, 3.University of Tokyo, 4.Institute for Space-Earth Environmental Research, Nagoya University, 5.Research Institute for Sustainable Humanosphere, Kyoto University, 6.Geophysical Institute, University of Alaska Fairbanks, 7.Center for Geospace Studies, SRI International

Afterglow of aurora at 732 nm can be used to track the plasma flow in the topside ionosphere at 300 km altitude (Dahlgren et al., 2009). From ground-based high-speed (50 fps and 200 fps) imaging observations made by Kataoka et al. (2015) at Poker Flat Research Range in Alaska, we found two interesting afterglow events on January 7 and January 28 2015, in which the speed of the brightest arc is suddenly accelerated within the field-of-view (15 deg by 15 deg). Both events occurred near the substorm onset. The existence of the afterglow is confirmed at wavelength range of >665 nm, and any contributions from major forbidden lines at 557.7 and 630.0 nm are rejected. The lifetime of the afterglow is an order of 5 s, which is consistent with the expected emissions from metastable O+ ions at 300 km altitude. The motion of afterglow is complicated and contains counterclockwise rotation. The maximum speed of the motion is more than an order of magnitude faster than those previously reported by Dahlgren et al. (2009). We report the results of the analysis of the optical flow to investigate the motion of afterglow, combined with the ionospheric conditions obtained by Poker Flat Incoherent Scatter Radar, and discuss the possibility of such a fast and complex plasma flow in the topside ionosphere. In addition, we have started our high-speed observation for this season in January. The accurate timing measurement of the imaging system has been realized by installing a newly developed GNSS timing board. That makes it possible to perform a synchronized observation with multiple cameras in different places. We also report our newly developed system in this presentation.

Keywords: Aurora, Afterglow, High-speed imaging

