Simultaneous observation of detachment of a bright Stable Auroral Red (SAR) arc by a ground-based camera and the Arase satellite on 4 November 2019

*Yudai Inaba[1], Kazuo Shiokawa[1], Shin-ichiro Oyama[1,9,10], Yuichi Otsuka[1], Atsuki Shinbori[1], Yoshizumi Miyoshi[1], Yoichi Kazama[2], Shiang-Yu Wang[2], Sunny W.T. Tam[3], Tzu-Fang Chang[3], Bo-Jhou Wang[2], Kazushi Asamura[4], Shoichiro Yokota[5], Satoshi Kasahara[6], Kunihiro Keika[6], Tomoaki Hori[1], Ayako Matsuoka[4], Yoshiya Kasahara[7], Atsushi Kumamoto[8], Shoya Matsuda[4], Yasumasa Kasaba[8], Masafumi Shoji[1], Iku Shinohara[4]

1. Institute for Space-Earth Environmental Research, 2. Academia Sinica Institute of Astronomy and Astrophysics, Taipei, Taiwan, 3. Institute of Space and Plasma Sciences, National Cheng Kung University, Tainan, Taiwan, 4. JAXA, 5. Osaka Univ., 6. Univ. Tokyo, 7. Kanazawa Univ., 8. Tohoku Univ., 9. Univ. of Oulu, Finland, 10. National Institute of Polar Research

Stable auroral red (SAR) arc is an aurora with dominant 630.0-nm emission of oxygen atoms generated at subauroral latitudes slightly lower than the aurora oval. SAR arcs were first reported in southern France [Barbier, 1958] and have long been investigated since then. Precipitating electrons (or heat flux) of ~several electronvolts (eV) have been considered as the source of SAR-arc emissions. Kozyra et al. [1997] noted that there were three possible mechanisms to generate these low energy electrons. The first hypothesis is the Coulomb collision between plasmaspheric electrons (energies less than 1 eV) and ring current ions (several tens of keV) [e.g., Rees and Roble, 1975; Kozyra et al., 1987]. The energy is transported into the ionosphere via heat conduction or as a low energy electron flux [e.g., Cole, 1965; Prolss, 2006]. The second hypothesis is that the Landau damping of electromagnetic ion cyclotron (EMIC) waves causes heated electrons and their pitch angle scattering and precipitation into the ionosphere [Cornwall et al., 1971]. The third is that the kinetic Alfven wave with the parallel electric field to the magnetic field accelerates plasmaspheric electrons to the ionosphere. In our previous study, we reported the first conjugate observation of a SAR arc on March 28, 2017 using an all-sky imager and the Arase satellite [Inaba et al., JpGU (PEM13-P14), 2019; Inaba et al., SGEPSS (R006-27), 2019]. We confirmed that EMIC or kinetic Alfven waves associated with the SAR arc were not observed by the Arase satellite and concluded that Coulomb collisions between ring-currrent protons and plasmaspheric electrons are the main cause of SAR arc generation. In this presentation, we show a new conjunction event of a bright Stable Auroral Red (SAR) arc observed by a ground-based camera and the Arase satellite on 4 November 2019. The conjunction was obtained at the time when the arc was detached equatorward from the main auroral oval. Similar to the previous event, the Arase satellite was near the plasmapause and in ring current at the crossing of the detaching SAR arc. However, Arase observed both electron and proton flux enhancements at energies below 1 keV near the magnetic equator over the bright detaching SAR arc (~1 kR). On the basis of these facts, we discuss the difference of particle and field characteristics between the newly-detached, bright arc on 4 November 2019 and the somewhat stable, faint arc on 28 March 2017.

Keywords: SAR arc, Arase satellite, All-sky camera

