Simultaneous Arase-ground observations of a purple and green auroral arc

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The purple auroral emission at a wavelength of 427.8nm is often caused by resonant scattering of sunlight by nitrogen molecular ions at the high-latitude part of auroral arcs, and can be a manifestation of ion upflow in the auroral ionosphere. We report the first particle observation for the source region of a purple/green auroral arc in the inner magnetosphere, which was made by the Arase satellite. The auroral arc appeared and expanded equatorward from ~0310 UT (midnight in local time) on September 11, 2018 at Nain, Canada, in association with the expansion phase of a substorm that occurred during the arrival of a corotating interaction region (CIR) in the solar wind. The auroral arc is characterized by purple and green emissions at the top and bottom parts, respectively, suggesting resonant-scattering of sunlight by auroral nitrogen molecular ions. Bi-directional field-aligned electrons with energies of ~keV were observed by the LEP-e onboard the Arase satellite during the arc crossing at L ~ 6.4, while source electrons become isotropic in the diffuse aurora afterwards. Electrons at energies of ~20 keV measured by the MEP-e of Arase also show a bi-directional (nearly) field-aligned distribution, while electron loss cone was identified at the arc crossing. The low-energy protons measured by LEP-i of Arase show time-pitch-angle dispersion from anti-earthward (180 degree) to earthward (0 degree) during the arc crossing. Based on these observations, we discuss physical mechanisms that cause these particle features and the observed purple/green auroral arc.

Keywords: purple auroral arc, simultaneous satellite-ground observation, field-aligned electron precipitation

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