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Recent scientific results from high-resolution core plasma imaging on Swarm and e-POP

ionospheric science; Swarm; e-POP

The Thermal Ion Imagers on Swarm A-C, and the Suprathermal Electron/Ion Imager on ePOP (now “Swarm E”) provide a unique view of charged particle distribution functions in the ionosphere at high time resolution (up to 100 images/s). Through high resolution, CCD-based imaging (~3000 pixels/image), ion drift velocity is derived from these images at a resolution of 20 m/s or better, and in general agreement with velocities derived from ground based radars [1] and an empirical convection model [2] . This talk reviews recent scientific applications of this technique, which are wide-ranging and include mechanisms of ion heating and upflow [3,4], M-I coupling via Alfven waves [5,6], electron acceleration and heating by Alfven waves [7,8, 9], intense plasma flows associated with “Steve” [10,11], and electrodynamics of large-scale FAC systems[12]. Finally, future opportunities made possible by these data will be discussed.

[1] Koustov et al. (2019), JGR, https://doi.org/10.1029/2018JA026245
[2] Lomidze et al. (2019), ESS, https://doi.org/10.1029/2018EA000546

[3] Shen and Knudsen (2020a), On O+ ion heating by BBELF waves at low altitude, JGR, in revision.
[4] van Irsel et al. (2020), Highly correlated ion upflow and electron temperature variations in the high latitude topside ionosphere, submitted to JGR.

[5] Pakhotin et al. (2020), JGR, https://doi.org/10.1029/2019JA027277
[6] Wu et al. (2020a), Swarm survey of Alfvenic fluctuations and their relation to nightside field-aligned current and auroral arcs systems, JGR, in revision.

[7] Liang et al. (2019), JGR, https://doi.org/10.1029/2019JA026679
[8] Wu et al. (2020b), e-POP observations of suprathermal electron bursts in the ionospheric Alfven resonator, GRL, submitted.
[9] Shen and Knudsen (2020b), Suprathermal electron acceleration perpendicular to the magnetic field in the topside ionosphere, JGR, in press.

[10] Archer et al. (2019), JGR, https://doi.org/10.1029/2019GL082687
[11] Nishimura et al. (2019), JGR, https://doi.org/10.1029/2019GL082460

[12] Olifer et al (2020), Swarm observations of dawn/dusk asymmetries between Pedersen conductance in upward and downward FAC regions, submitted to JGR.