

# New In-situ Ion Composition and Velocity Observations in the Topside Ionosphere from the Swarm-E Ion Mass Spectrometer

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The imaging and rapid-scanning ion mass spectrometer (IRM) onboard the polar-orbiting Swarm-E (e-POP) satellite is a new type of ion mass spectrometer that combines the techniques of hemispherical electrostatic deflection and ion time-of-flight analysis, with the unique capability of measuring simultaneously both the ion composition distribution and the detailed ion velocity distributions of individual ion species. We present several new observation results of the low, mid, and high-latitude topside ionosphere (300-1500 km altitude), from both detailed and statistical analyses of IRM data acquired in the first five years of the Swarm-E mission (since the launch in September 2013). These include the enhancement of minor ion composition at high latitudes, including N<sup>+</sup> and molecular ions; localized regions of heavy ion up-flows and down-flows in the F-region auroral ionosphere; and bi-directional light ion flows at mid-latitudes; among others. We discuss the implications of these observation results in the context of both magnetosphere-ionosphere and ionosphere-thermosphere coupling.

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