

Enhancement of the Jovian Magnetospheric Plasma Circulation Caused by the Change in Plasma Supply From the Satellite Io

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The innermost Galilean satellite, Io, supplies a large amount of volcanic gases to the Jovian magnetosphere, and the outward transport of ionized gasses is responsible for forming a huge and rotation-dominant magnetosphere. The plasma supply from the satellite has a key role in the characterization of the Jovian magnetosphere. In fact, significant variations of the plasma population in the inner magnetosphere caused by the volcanic eruptions in Io were found in the early 2015, using a continuous data set of the Io plasma torus obtained from an extreme ultraviolet spectroscopy onboard the HISAKI satellite. From the time evolution of the Io plasma torus radial distribution, it was found that enhanced plasma supply from the inner to the middle magnetospheres occurred during approximately 50 days and the average outward speed is estimated to be 140 m/s. Intense short-lived auroral brightenings—which represent transient energy releases in the outer part of the magnetosphere—occurred frequently during this period. The short-lived auroral brightenings accompanied well-defined sporadic enhancements of the ion brightness in the plasma torus, indicating a rapid inward transport of energy from the outer part of the magnetosphere and the resultant enhancement of hot electron population in the inner magnetosphere. This is the first observational evidence showing that the strength of a plasma source in the inner magnetosphere can control a large-scale radial circulation of mass and energy in a rotation-dominant magnetosphere.

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