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Juno/JIRAM observation of Io and Ganymede's auroral footprints and associated tails

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JIRAM (Jovian Infrared Auroral Mapper) is an imaging spectrometer on board the NASA/Juno spacecraft. The throughput of one of the imager channels (L band) is designed to observe the auroral emission due to the H3+ ion; the surface resolution, when Juno is close to Jupiter's poles, is as small as $\sim$10 km. Combined with the unique vantage point provided by Juno, JIRAM observed the auroral footprints with unprecedented details. These auroral footprints are made of bright spots (and an associated tail) that appear in Jupiter's ionosphere at the foot of the magnetic field lines that swept past Io, Europa, and Ganymede. The moons are slow-moving obstacles in the path of Jupiter's rapidly rotating magnetospheric plasma and the resulting electromagnetic interaction launches Alfven waves along the magnetic field lines towards Jupiter, where an intense electron bombardment of the hydrogen atmosphere causes it to glow.

Recent observations reveal for the first time that the footprint of Io consists of a regularly spaced array of emission features, extending downstream of the leading footprint, resembling a repeating pattern of swirling vortices (von Kármán vortex street) shed by a cylinder in the path of a flowing fluid. The small scale of these multiple features ($\sim$100 km) is incompatible with the simple paradigm of multiple Alfven wave reflections, which indeed explain the large scale multiplicity already observed.

Observations of Io's trailing tail well downstream of the leading feature reveal a pair of closely spaced parallel arcs that were previously unresolved by Earth orbit observations. Both of Ganymede's footprint components (main and secondary) appear as a pair of emission features that evidently provides a remote measure of Ganymede's magnetosphere, mapped from its distant orbit onto Jupiter's ionosphere.