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A new interpretation of the Io UV footprint morphology

B. Bonfond, D. Grodent, J.-C. Gérard and A. Radioti
LPAP, Université de Liège, Belgium

The electromagnetic interaction between Io and the jovian magnetic field leads to an auroral UV footprint consisting of single or multiple UV spots in both jovian hemispheres. According to current theories, the perturbation induced by the motion of Io in the plasma torus propagates along the field lines in the form of Alfvén waves and finally causes electron precipitation in the jovian ionosphere. The occurrence and multiplicity of the secondary spots appear to be related to the position of Io in the plasma torus and have been attributed to partial reflections of the Alfvén waves on the torus boundaries. Nevertheless, the discrepancies between the predicted inter-spot distances and the measurements were found difficult to explain. Additionally, some crucial configurations of Io in the torus had never been observed.

Our recent HST/ACS observations of the footprint in so far unexplored Io-plasma torus configurations lead to the finding of a new feature in the footprint: a faint spot upstream of the main spot. The observations of this precursor emission, together with the inconsistencies related to the inter-spot distances, suggest a new interpretation of the footprint morphology. We propose that the precursor and the first secondary spot stem from the same mechanism and we interpret them as the counterparts of the main spot occurring in the opposite hemisphere.