EPSC Abstracts
Vol. 8, EPSC2013-539, 2013
European Planetary Science Congress 2013
© Author(s) 2013

The Ganymede auroral footprint: implications of the spots' multiplicity

B. Bonfond (1,2), S. Hess (3), F. Bagenal (4), D. Grodent (1), J.-C. Gérard (1), A. Radioti (1), J. Gustin (1) and J. T. Clarke (5)
(1) Université de Liège, Belgium, (2) , Southwest Research Institute, Colorodo, USA (3) Université de Versailles - Saint Quentin, France, (4) University of Colorado at Boulder, Colorado, USA, (5) Boston University, Massachusetts, USA
(b.bonfond@ulg.ac.be / Fax: +32-4-3669711)

Abstract

We report here the finding of a secondary spot for the Ganymede auroral footprint on Jupiter. Moreover, we characterize the evolution of the Ganymede footprint morphology with longitude and time. Finally, we discuss the implications of these results with respect to the morphology of the other satellite footprints.

1. Introduction

The satellite auroral footprints are the signature of the electro-magnetic interaction between the moons and the magnetosphere. In images acquired with the Hubble Space Telescope (HST), they generally appear as single spots located near the field lines connected to the satellite. However, the Io footprint, the brightest one, is made of at least three consecutive auroral spots and is followed in the downstream direction by an extended tail. One of the spot is associated with the main Alfvén wing, i.e. with the Alfvén waves directly transmitted from Io to Jupiter and accelerating electrons towards Jupiter. Some of the electrons accelerated in the main Alfvén wing are accelerated in the opposite direction to form trans-hemispheric electron beams. A significant part of them will then precipitate in the opposite hemisphere, generating another spot. Finally, the Alfvén waves can also be reflected by the density gradient at the boundary of the plasma torus to form a reflected Alfvén wing. A third spot is associated with the ionospheric foot of this reflected wing (see review by Bonfond, 2012 [1]). Additionally, the relative distance of the spots evolves as Io moves up and down in the plasma torus. Such a complex morphology and behaviour had only been observed for the Io footprint, not for the others...yet.

2. Results

We present evidences showing that the Ganymede footprint is generally composed of 2 spots on most HST images of the southern aurora. Additionally, pairs of spots have been observed in the North, but they are much rarer. Similarly to the Io footprint, the distance between the spots evolves with the System III longitude of the moon. These results indicate that the mechanisms at play for the Io footprint are most probably universal and take place at Ganymede too. This would imply that Europa and Enceladus also have multiple spots, even if they have not been observed yet due to their faint signature. Moreover, images acquired in similar configurations but at different times display different inter-spot distances. Such a behaviour possibly arises from variations of the plasma sheet density along the Ganymede orbit.

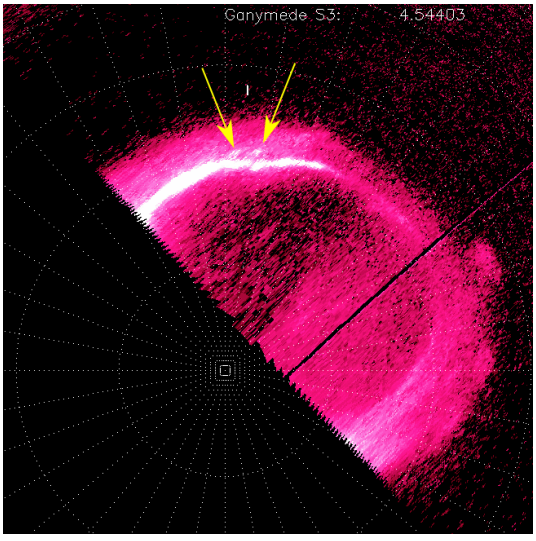

Figure 1: Polar projection of the southern aurora on Jupiter. The Yellow arrows indicate the location of the two Ganymede footprint spots.

References

[1] Bonfond, B.: When the moons create aurora: the satellite footprints on giant planets, in Auroral Phenomenology and Magnetospheric Processes: Earth and Other Planets, Geophys. Monogr. Ser., vol. 197, edited by A. Keiling et al. 133–140, AGU, 2012.