Observations of small scale structures in the footprint of the Galilean satellites by JIRAM

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The Jovian Infrared Auroral Mapper (JIRAM) on board Juno is a spactro-imager mainly designed to inspect the atmosphere of Jupiter and its auroral emission. It includes two imagers in the L (3.3-3.6μm) and M bands (4.5-5.0μm) and a spectrometer operating at 2-5 μm.

The orbit of Juno and the high resolution of the JIRAM imager allowed to acquire images of moon-related aurorae in great detail. These images show a rich morphology including a main spot, a potential precursor, a sequence of trailing spots and a fading tail. The phenomenon is due to the jovian magnetic field sweeping past the Galiean moons, which generate Alfven waves travelling towards the ionosphere and set up field aligned currents. When the associated electrons reach the ionosphere, they interact with the hydrogen and make it to glow.

Here we focus on the small scale structure close to the main spot acquired using the L-band of the imager from perijove 7 to perijove 26. This feature extends for aboout 4000 km and the typical distance between the spots in the southern emisphere lies between 250 and 600km for both the Io and Ganymede footprints. This distance decreases to 150km in the northern emisphere, which is the same scale length observed for the Euorpa footprint in the South Pole. So far we found no correlation with orbital parameters such as the longitude of the moons, which suggest us that such morphology is almost purely due to ionospheric processes.

A puzzling feature is the stillness of the secondary spots observed during PJ13 (Fig.1). The brightness of the highlighted spots fades as time goes by, but their position remains the same, as can be noticed by contrast with the moving main spot. This behaviour is consistently observed also during orbits 14, 16 and 26.

The characteristics of these spots are incompatible with multiple reflection of Alfven waves between the two emispheres. Instead, we are currently investigating ionospheric processes like the feedback instability (FI) as a possible candidate to explain the generation of the observed small scale structure. This process relies on local enhacement of conductivity in the ionosphere, which is affected by electron precipitation. Besides, we are also considering the interplay between the ionospheric resonator and the FI as a possible underlying mechanism.

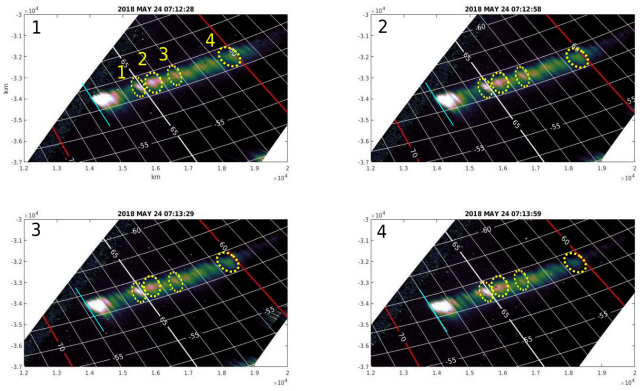

Figure 1: Images of the Io footprint during PJ13.