Monitoring of Jupiter's magnetosphere with the moon-induced aurora during the Juno era

Alessandro Moirano[1,2], Bertrand Bonfond[1], Alessandro Mura[2], Vincent Hue[3], Andrea Caruso[4,5], Bilal Benmahi[1,3], Denis Grodent[1], Linus Alexander Head[1], Jean-Claude Gérard[1], Guillaume Sicorello[1], Thomas K. Greathouse[6,] Luis Gomez Casajus[4,5], Paolo Tortora[4,5], Marco Zannoni[4,5], the JIRAM team[2,7,8]

[1] *Laboratory for Planetary and Atmospheric Physics. Space Sciences, Technologies and Astrophysical Research Institute, University of Liège, Liège, Belgium*
[2] *Institute for Space Astrophysics and Planetology, National Institute for Astrophysics (INAF-IAPS), Rome, Italy*
[3] *Aix-Marseille Université, CNRS, CNES, Institut Origines, LAM, Marseille, France*
[4] *Department of Industrial Engineering, Alma Mater Studiorum - Università di Bologna, Italy*
[5] *Centro Interdipartimentale di Ricerca Industriale Aerospaziale, Alma Mater Studiorum - Università di Bologna, Italy*
[6] *Southwest Research Institute, San Antonio, Texas, USA*
[7] *Institute of Atmospheric Sciences and Climate, National Research Council, Bologna, Italy*
[8] *Italian Space Agency, Rome, Italy*

At Jupiter, the interaction between its four major moons - Io, Europa, Ganymede and Callisto - and the magnetosphere produces satellite-induced auroral emissions, called footprints. These are caused by the flow of magnetospheric plasma past the moons, which triggers a local perturbation that generates mainly Alfvén waves propagating down to the planetary ionosphere. Here, the Alfvén waves accelerate electrons into the ionosphere, where auroral emissions are generated. The morphology of the footprints is determined by the shape of the wave-fronts of the Alfvén waves, which is mainly affected by the magnetic field and plasma density. Therefore, the footprint implicitly contains information on those quantities.

Since 2016, the Juno mission has been providing high-quality observations of Jupiter's polar regions in the infrared (IR) and ultraviolet (UV) bands. We propose an overview of the IR and UV observations of the footprints from Juno, with a particular focus on Io, to highlight how these remote-sensing data can be used to obtain information on the magnetospheric environment and its variability, as well as on the Jovian ionosphere. We will show how we used the IR and UV observations of the Io footprint to determine the density and temperature of the Io Plasma Torus around Jupiter between 2016 and 2022. To support this survey, the radio occultations performed by the radio tracking systems have been included, as they wrap information on the electron content of the Io Plasma Torus. We found that the Io Plasma Torus can exhibit large variations (factor ~2-3) in density and temperature over a couple of months. We are currently investigating the UV vertical profile of the Io footprint, which allow to investigate the energy deposited on Jupiter by the moon-magnetosphere interaction from remote sensing observations.