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At the other end of the field lines: the satellite footprints

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The electromagnetic perturbations caused by the interaction between the moons Io, Europa, and Ganymede and the Jovian magnetosphere propagate along magnetic field lines in the form of Alfvén waves and finally create auroral footprints in Jupiter's polar ionosphere. Thanks to the high spatial and temporal resolution of the Hubble Space Telescope, the analysis of the footprints in the Far UV domain provides extremely valuable information on these interactions.
In the case of the Io footprint, the analysis of the multiplicity of the auroral spots and of their relative motion resulted into a new understanding of the far field interaction, which involves trans-hemispheric electron beams. Consistent with the in-situ energetic electrons observations, this scenario has been later reinforced by theoretical models simulating the Alfvén wave's propagation and the ways these waves accelerate electrons. Moreover, while the altitude and the vertical profile of the auroral emissions provide crucial information on the energy of the precipitating electrons, the measure of the shape of the different sub-structures of the satellite footprints provides important clues about the size of the interaction region. The evolution of the footprint brightness is also an essential parameter for understanding the energies involved in the interaction. Finally, the study of the satellite footprints can also be used for broader purposes than just the investigation of the satellite-magnetosphere interaction, such as building more accurate Jovian magnetic field models.