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Auroral footprints; everywhere

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Jupiter's moons Io, Europa and Ganymede are continuously interacting with the Jovian magnetic field and with the sheet of plasma flowing near its equatorial plane. The interaction between these moons and the Jovian magnetosphere causes strong Alfvénic perturbations which propagate along the magnetic field lines. On their way towards Jupiter's polar regions, these perturbations accelerate charged particles which then interact with Jupiter's ionosphere where they loose a fraction of their energy in the form of auroral emissions. Each of the three moons leaves an auroral footprint around the poles of Jupiter which departs from the bulk of the auroral emission. Their location is mainly controlled by the topology of the field lines and thus analysis of the auroral footprints provides information on the magnetic field itself. In that regard, the satellites auroral footpaths were used to highlight the presence of a strong magnetic anomaly in the northern hemisphere of Jupiter. Detailed inspection of the footprints' brightness and morphology as a function of time reveals fundamental information on the interaction mechanisms near the moons, on the particles acceleration mechanisms as well as on the Jovian ionosphere. For example, it was suggested that the Io footprint actually consists of several spots resulting from successive steps in the perturbation propagation process. Another example is the finding of three different timescales in the variations of Ganymede's footprint; each of them is pointing to a different part of the electromagnetic interaction between the moon's mini-magnetosphere and the Jovian plasma.
Several recent images of Saturn's auroral regions obtained with Cassini/UVIS at high latitude show an obvious auroral spot at the predicted location of Enceladus' footprint. This major finding demonstrates that the electromagnetic interaction between a moon and its parent planet is not unique to Jupiter but appears to be a common feature in planetary systems.