



Close and distant signatures of the icy moons of Saturn

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Close flybys of Enceladus, Tethys, Dione, Rhea and Hyperion by Cassini have provided a unique opportunity to understand the interactions of unmagnetized icy moons with a subsonic, sub-Alfvenic plasma. In this presentation, we examine the magnetic signatures of these moons to infer whether the moon is a net contributor to the plasma or an absorber like the Earth's moon. A mass-loading moon or a moon with an external conductivity (as from an ionosphere) slows and deflects the plasma impinging on it. As a result, the magnetic field lines drape around the moon and have a higher field strength upstream of the moon and a depressed strength downstream of the moon. When an inert moon interacts with the plasma, the plasma impinging on the moon is absorbed, the magnetic field upstream remains unperturbed but shows an enhancement in the wake region.

The magnetic field observations from Enceladus confirm that it is the main source of plasma in Saturn's magnetosphere. Surprisingly, Dione also displays the characteristics of a plasma loading moon, even though its net contribution to the plasma in the Saturnian magnetosphere is expected to be small.

Tethys and Rhea clearly belong to the class of mass-absorbing moons. The wakes of these moons were observed to have enhanced field strengths and the magnetic field appeared to be drawn into the wakes from the flanks. However, it must be pointed out that the most sensitive measurement of mass-loading is provided by those passes which occur just upstream of the moons. Until, we obtain such measurements in the extended mission, some mass-loading at these moons cannot be ruled out.

The strength of ion-cyclotron waves observed in Saturn's magnetosphere show an enhancement close to Enceladus' position, indicating that the moon is a source of neutral particles. We also find an enhancement near Dione, indicating that this moon

also adds materials to the system, although the calculated ionization rate there is an order of magnitude less than near Enceladus.

Finally, no field signature was observed to be associated with Hyperion. This may be due to the large distance of the wake flyby such that that the wake had dissipated at the location of Cassini. Alternatively, the plasma flow may have had a large deviation from the corotation flow direction making the spacecraft miss the wake crossing.