



Magnetic signature of Iapetus' interaction with the solar wind

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When the Cassini spacecraft flew by Iapetus in September 2007, the moon was in the solar wind upstream of Saturn. Cassini approached Iapetus from downstream and from the side, but did not pass through the moon's wake. In the five days leading up to the encounter, the interplanetary magnetic field (IMF) was steady and magnetically disconnected from the nominal saturnian bow shock. When the spacecraft reached where the steady IMF should have mapped to Iapetus, from a point downstream and to the side of the moon, the magnetometer observed a strong perturbation roughly the diameter of the moon. For an absorbing body in the solar wind, such as Earth's moon, a geometric wake is formed downstream. Cassini is too far to the side of the moon to observe such a wake. The observed signature consists of a magnetic enhancement pointing upstream of Iapetus, a southward deflection of the field, and a magnetic depression pointing downstream of the moon. This is not the expected signature. The observed signature is similar to what would be expected for a body acting as an obstacle to the solar wind, either by an intrinsic magnetic field or through local mass loading. At Iapetus' distance from the sun, the proton inertial length and thermal proton gyroradius are on the order of the moon's radius. This is a region of parameter space previously unexamined in global interaction studies. We interpret the magnetic signature as that caused by an obstacle to the solar wind and discuss implications for the source of the obstacle.