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Evidence for a magnetic pileup boundary at Titan: Cassini Spacecraft observations

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The measurements obtained by the Cassini magnetometer (MAG) and plasma instruments during the first flybys of Titan provided invaluable information on the interaction of the Saturn's largest moon with its plasma environment. On one hand, the virtual absence of a significant global magnetic field and the presence of a dense atmosphere make Titan's interaction with Saturn's magnetosphere very similar to the solar wind interaction with Mars, Venus and comets. This implies the formation of a magnetic barrier above Titan's ionosphere on the upstream side, and the development of a magnetic tail generated from the draping of the magnetospheric field lines, as they pass by the satellite accompanying the co-rotational flow. On the other hand, the variability of the upstream conditions (especially the variation in the angle between the co-rotational flow and the solar EUV radiation direction) as Titan moves on its orbit around Saturn produces a rich variety of unparalleled scenarios which make Titan's interaction unique. Previous studies on the solar wind interaction with Mars, Venus and comets revealed the presence of a sharp plasma boundary marking the entry into the magnetic barrier and tail lobes: the Magnetic Pileup Boundary (MPB). At these objects the MPB has been identified from a series of very clear observational signatures including: a strong gradient in the magnetic field magnitude, the enhancement of the magnetic field draping, and strong changes in the local electron distribution and in the dominant ion population. In this work we present evidence in favor of the occurrence of a magnetic pileup boundary at Titan as implied by Cassini magnetic field and plasma data. We study the structure of this boundary and we compare its charac-

teristics with those at Mars, Venus and comets. Finally, we comment on significance of this boundary for the current exospheric models.