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Interplanetary conditions and magnetospheric dynamics during the Cassini orbit insertion fly-through of Saturn's magnetosphere

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We consider observations of the magnetic field and Saturn kilometric radiation (SKR) during the Saturn orbit insertion (SOI) fly-through of Saturn's magnetosphere by the Cassini spacecraft in June-July 2004, and their relation to concurrent conditions in the interplanetary medium. Examination of Cassini interplanetary magnetic field (IMF) data over five solar rotations bracketing the fly-through shows that the phasing of recurrent corotating interaction region (CIR) compressions in the heliosphere is such that one of them is expected to have impinged on Saturn while Cassini was inside the magnetosphere. Magnetic field data before and after the encounter confirm that the expected heliospheric current sheet (HCS) crossing took place while Cassini was inside. The effect of the passage of the 'same' CIR compression six solar rotations earlier was observed by the Hubble Space Telescope (HST) and by Cassini during its approach to the planet at the end of January 2004, and was found to produce major enhancements in UV aurora and SKR emissions. Enhancements in SKR emissions were also observed during subsequent passages of this CIR bracketing the SOI fly-through. Here we show that major bursts of SKR were observed by Cassini on the outbound pass during the SOI fly-through which show considerable similarity to those observed during the January 2004 CIR compression event. In particular, both are associated with

extensions to lower frequencies, and both also produce disruptions of the usual SKR modulation at the planetary rotation period. We thus suggest that the bursts observed during the SOI fly-through were associated with an auroral enhancement event of the same nature as observed by the HST at the end of January 2004, produced by the effect of the anticipated CIR compression of the magnetosphere. Simultaneous Cassini measurements of the magnetic field in the nightside magnetosphere indicate the injection of hot plasma at the spacecraft in association with the main SKR burst, which we suggest could have been due to the onset of reconnection in the tail in conformity with recent theoretical discussion.