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The solar wind interaction at Saturn

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The question of whether Saturn's magnetosphere is driven externally by the solar wind interaction (as at Earth) or actuated internally by rotation (as at Jupiter) is beginning to be answered by a combination of in-situ and remote observations. In January 2004 we were provided with a unique opportunity to sample the solar wind and interplanetary magnetic field (IMF) upstream of Saturn using the Cassini plasma and fields instruments, whilst simultaneously observing the ultraviolet aurora in Saturn's southern ionosphere using the Hubble Space Telescope (HST). The highly-dynamic nature of Saturn's aurora revealed by these HST observations appears to relate directly to the concurrent solar wind activity measured by Cassini -specifically with the arrival of a corotating interaction region (CIR) related compression region at Saturn. Such events have recently been suggested to produce rapid bursts of tail reconnection, and consequent auroral dynamics. In addition, compression regions have been correlated with bursts of Saturn Kilometric Radiation (SKR) measured remotely by RPWS on Cassini, indicative of enhanced magnetosphere-ionosphere coupling and auroral activity. During the first fly-through Saturn's magnetosphere of Cassini in July 2004, it is thought that a CIR-related compression once again impinged upon Saturn's magnetosphere. The fields and particles data suggest that this took place during the outbound pass, as Cassini suddenly became engulfed in hot plasma during an interval of field dipolarisation (as in terrestrial substorms), whilst RPWS simultaneously measured an SKR burst. We suggest that this is the in-situ evidence of rapid tail reconnection suggested to relate to the arrival of the compression region and subsequent auroral activity seen in January 2004.