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Synthesised mapping of magnetospheric equatorial regions at Saturn from Cassini Prime Mission observations

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Abstract

Saturn's rich magnetospheric environment contains uniquely diverse regions compared with those observed elsewhere in the solar system, with a large number of diverse magnetospheric processes and phenomena. Understanding these regions, their dynamics and equilibria, and how they interact with the rest of the system via the exchange of mass, momentum and energy is important in understanding the system as a whole. This represents a challenge to theorists, modellers and observers. Studies of Saturn's magnetosphere based on Cassini data have revealed a system which is temporally highly variable and which has made understanding the physics of Saturn's magnetosphere all the more difficult. Cassini data provide us also with a unique opportunity for comparative studies of the saturnian, jovian and terrestrial magnetospheric environments. Saturn's magnetosphere may appear Jupiter-like in that both contain significant internal plasma sources and are fast rotating magnetospheres. However multiphase (solid, neutral, plasma) interactions at Saturn gives this magnetosphere a unique flavour in the solar system, whereas the combination of both solar wind and rotational effects produces a highly complex magnetosphere which appears to be more solar-wind influenced that the jovian magnetosphere.

In this paper, knowledge of Saturn's equatorial magnetosphere will be presented and synthesised into a global picture. Data from the Cassini magnetometer (MAG), low-energy plasma spectrometers (CAPS), energetic particle detectors (MIMI), radio and plasma wave instrumentation (RPWS) and cosmic dust detectors (CDA) are combined to provide a multi-instrumental identification and characterisation of magnetospheric regions at Saturn. An emphasis is placed on the physical processes at work in each region and at their boundaries.