Geophysical Research Abstracts
Vol. 12, EGU2010-8790-2, 2010
EGU General Assembly 2010

Monitoring plasma transport in Saturn's inner magnetosphere through icy moon microsignatures

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Cassini's 5 year observations of Saturn[1]s radiation belts has led to the
detection of more than 300 microsignatures. Briefly, microsignatures are localized decreases or bite-outs in the flux of trapped charged particles due to recent absorptions by a moon. While their use as a diagnostic of magnetosphere structure has been long established, the extensive Cassini data set has made their analysis a much more powerful tool for magnetospheric studies. New techniques that utilize the energy structure of the microsignatures have helped to reveal the overall electron drift shell shape in Saturn[1]s magnetosphere (translating to inferences about properties of the electromagnetic field), inward radial velocities at the distance of Enceladus and intense, localized and time variable azimuthal electric fields at the L-shell of Tethys. The same dataset provides hints that the process of the dust-driven, flux tube interchange instability may be active in the inner edge of the E-ring and the G-ring. We will review these new analysis techniques and discuss the aforementioned results as well as additional future applications, in order to highlight the importance of microsignature observations, not only for Saturn, but for all the outer planets that have plasma absorbing moons within their radiation belts.