

Saturn's dynamical magnetosphere: Energetic particles and neutrals from the magnetosphere imaging instrument (MIMI) on Cassini

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The MIMI investigation comprises three sensors covering the indicated energy ranges: the Ion and Neutral Camera (INCA) -- 3 keV/nuc <E<200 keV/nuc (ions/neutrals): Charge-Energy-Mass-Spectrometer (CHEMS) -- 3<E<230keV/e (ions),, and Low Energy Magnetospheric Measurement System (LEMMS) 0.03 <E<18 MeV (ions)/0.02 <E<0.9 MeV (electrons). Also, LEMMS measures highenergy electrons (E>3 MeV) and protons (1.6 < E < 160 MeV) from the opposite end of the dual field-of-view telescope. Measurements by MIMI following Saturn orbit insertion on 1 July 2004 revealed: (1) a dynamical magnetosphere with a day-night asymmetry and an 11-hour periodicity; (2) several water-product ions (O+, OH+, H2O+), but little N+; (3) inferred quantities of neutral gas sufficient to cause major losses in the trapped ions and electrons in the middle and inner magnetosphere; (4) a Titan exosphere that is a copious source of energetic neutral atoms (ENA); (5) a previously unknown radiation belt residing inward of the D-ring that is most likely the result of double charge-exchange between the main radiation belt and the upper layers of Saturn's exosphere. Finally, MIMI data show evidence of injections of plasma on the night-side of the planet, some substorm-like in the magnetotail and others in the 7-10 Rs region that subsequently corotate with the planet for a number of days before dissipating. There are many similarities, but also differences with the Voyager 1, 2 measurements some 24 years earlier. These observations will be presented and discussed in the context of current theoretical models of Saturn's magnetosphere.