

Overview of Results from the Cassini Magnetospheric Imaging Instrument (MIMI) During the First Year of Operations

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The MIMI investigation comprises three sensors covering the indicated energy ranges: the Ion and Neutral Camera (INCA) -- 7 keV/nuc $< E < 200$ keV/nuc (ions/neutrals): Charge-Energy-Mass-Spectrometer (CHEMS) -- $3 < E < 230$ keV/e (ions), and Low Energy Magnetospheric Measurement System (LEMMS) 0.02 $< E < 18$ Mev (ions)/0.015 $< E < 1$ Mev (electrons). Also, LEMMS measures high-energy electrons ($E > 3$ Mev) and protons ($1.6 < E < 160$ Mev) from the back end of the dual field-of-view telescope. The Saturn observation sequences began in January, 2004 and culminated in Saturn Orbit Insertion on July 1, 2004. The MIMI sensors observed substantial activity in interplanetary space for several months prior to SOI, including several interplanetary shocks associated with corotating interaction regions, numerous increases most likely originating from particle streams in the vicinity of the Saturnian bow shock and energetic neutral atoms (ENA) emanating from Saturn's magnetosphere. Results following SOI revealed: a dynamical magnetosphere with a day-night asymmetry and an 11-hour periodicity; several water-product ions (O^+ , OH^+ , H_2O^+), but little N^+ ; inferred quantities of neutral gas sufficient to cause major losses in the trapped ions and electrons in the middle and inner magnetosphere; a Titan exosphere that is a copious source of ENA; INCA imaging through ENA has also revealed 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, there is ample evidence for the presence of substorm-like injections of plasma that subsequently corotates for a number of days before dissipating on the night-side magnetotail. The observations will be presented and discussed in the context of current theoretical models.