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Preliminary results on the Saturnian neutral cloud density and structure, based on Cassini/MIMI measurements

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Energetic Neutral Atoms (ENA) result from charge exchange collisions between fast ions trapped in planetary magnetic fields and residual neutral gases resident in the magnetosphere. ENAs thus escape and can be detected and imaged to produce a picture of the population in the entire magnetosphere.

Assuming that the Energetic Neutral Atom flux is j_{ENA}(E), then the aforementioned process can be written as a line-of-sight integral over the ion flux of the i-species j_i(E) and the cold neutral gas exospheric density for k-species n_k(l), multiplied by the charge exchange cross section between i-ions and the k-exospheric atoms.

$$j_{ENA}(E) = \Sigma_k \sigma_{ik}(E) \int j_i(E)\, n_k(l)\, dl \quad (1)$$

The Magnetospheric IMaging Instrument (MIMI) on Cassini includes the Ion and Neutral Camera (INCA) to image ENAs. It is evident from equation (1) that by measuring both the ion and ENA intensities we can deduce the line density n(l) of the residual neutral gas cloud. We have surveyed the Cassini/MIMI data for the first 3.5 years of operation and constructed spectra of both ions and ENAs for the prevailing species of H and O. Typical H+ spectra fit a power law in energy with slope of -2, while adjacent neutral spectra exhibit an exponent of -2.8 on day 16, 2006 at 0320 and 0253 UT, respectively at L=14.8 Rs. We will report preliminary results on neu-

tral cloud line density distributions and composition in various parts of the Kronian magnetosphere.