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The Compton-Getting effect in energetic neutral atom images of Saturn's magnetosphere

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The Cassini Ion and Neutral Camera (INCA) images local energetic ion populations and energetic neutral atoms (ENAs). When INCA was pointed towards Saturn as Cassini approached the planet, it nearly always detected a flux of ENAs, produced in collisions between energetic ions and neutral gas, mainly inward of 10 Saturn radii. Our measurements show that ENA fluxes integrated over the entire 90x120 degree image have quasi-sinusoidal time variations; images indicate the maxima are associated with midnight and minima with local noon. Oxygen ENAs show a more pronounced peak-to-valley ratio than hydrogen ENAs. We are putting forward the following hypothesis in this paper. An energetic ion population is injected deep within the magnetosphere and this population begins to corotate with the planet. Viewed as Cassini approaches Saturn near the dawn meridian, the ENA intensity from near midnight is enhanced because of the ion Compton-Getting effect. Conversely the ENA intensity from near noon is diminished, when the plasma is retreating from Cassini. For the same reason, we predict that when Saturn's magnetosphere is viewed from local dusk, the ENA intensity associated with injected plasma would be higher near noon than midnight.