

Supporting Information for “Saturn’s quasi-periodic magnetohydrodynamic waves”

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Similarity between QP60 observations

We present observations from DOY 341 of 2006 in Fig. S1 to show the similarities between the QP60 events discussed in this study and those reported in previous works. Electron spectrograms measured with the LEMMS and ELS (for energies between 0.05 and 26 keV) instruments are shown in Figs. S1a and b respectively. Also shown in Fig. S1a is the modified (see caption) differential flux for the LEMMS C1 channel (27-48 keV). Fig. S1c shows the ELS pitch angle distribution. Fig. S1d shows the RPWS electric field spectrogram with the white line representing the local electron cyclotron frequency. Fig. S1e shows the perpendicular MFA magnetic field components ($\delta b_{\perp\nu}$ in blue and $\delta b_{\perp\phi}$ in red).

The LEMMS and ELS electron spectrograms show two regions of enhanced electron intensities centered approximately at 04:00 and 16:00 hours. The LEMMS data has some low energy sunlight contamination in the second enhancement. These electron signatures are typically associated with the ~ 10.7 hour modulation of the magnetic periods and the ELS electron pitch angle distribution (Fig. S1c) shows that these electron enhancements are field-aligned beams. The RPWS electric field spectrogram (Fig. S1d) shows that there are quasi-periodic bursts of whistler-mode waves separated by ~ 1 h. These whistler bursts are observed after the field-aligned electron beams and are coincident with most of the magnetic fluctuations shown in Fig. S1d. The periodicity and temporal coincidence of the fluctuations above suggest that the particle, radio and magnetic fluctuation events are related to those reported in previous studies (e.g. *Mitchell et al.*, 2009, *Badman et al.*, 2012, *Roussos et al.*, 2016, *Palmaerts et al.*, 2016).

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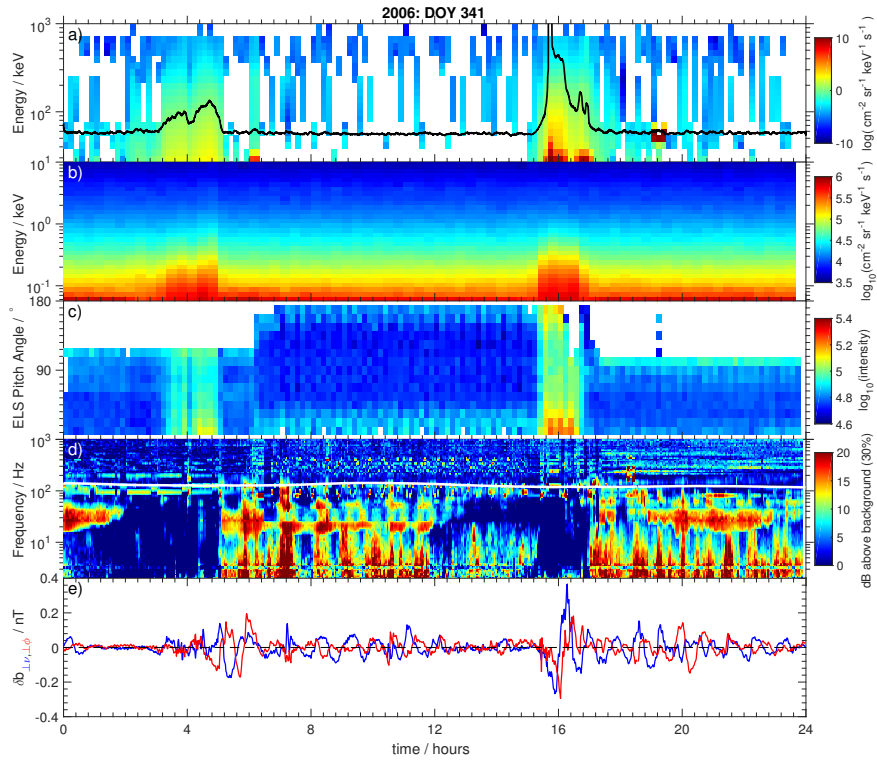


Figure 1. a) shows the MIMI-LEMMS electron spectrogram for DOY 341 and the LEMMS C1 differential flux in black. Note that the magnitude of this differential flux has been modified by $(50 + 10 \times C1)$ in order to fit on the plot. b) shows the CAPS-ELS electron spectrogram using only anode 5 and energies 0.05–26 keV for DOY 341. c) shows the corresponding CAPS-ELS pitch angle distribution. d) shows the RPWS electric field spectrogram with the white line representing the local electron cyclotron frequency. e) shows the perpendicular MFA magnetic field components ($\delta b_{\perp V}$ in blue and $\delta b_{\perp \phi}$ in red).