

## Supplementary Material for Proton Aurora and Relativistic Electron Microbursts Scattered by an EMIC Wave

## **1 SUPPLEMENTARY DATA**

This is the Supplementary Data for the Shumko et al., "Proton Aurora and Relativistic Electron Microbursts Scattered by an EMIC Wave" manuscript. It contains the captions to two movies and two figures.

## 1.1 Movie Captions

**Caption to movie\_S1**: This movie shows images from THEMIS-TPAS and the magnetic field spectrum observed by CARISMA-GILL. Panel a shows the THEMIS-TPAS images, mapped to an assumed 110 km aurora emission altitude. The intensity limits are identical for all images, to tease out the small variations in intensity. The imager turned on at 00:22:06 UT and was immediately saturated by twilight and a terrestrial light source in the lower-left corner (south-west). The imager clearly observed the IPA from around 00:35 to 01:20 UT. Panel b shows the CARISMA-GILL magnetic field spectrum, displaying an EMIC wave that began at midnight UT. Its frequency ranged between 0.2 and 0.4 Hz. While twilight prevents us from commenting on the timing of when the two phenomena begun, the data clearly show that both were concurrent and ended around the same time.

**Caption to movie\_S2**: This movie shows the  $\approx 2$  minute conjunction between SAMPEX and THEMIS-TPAS. The images in panel a are plotted in the same way as movie\_S1 with the entire SAMPEX footprint, also mapped to 110 km, superposed and shown with the red line. We show the instantaneous SAMPEX footprint with the red circle. Panel b shows the > 1 MeV electron counts observed by SAMPEX-HILT at this time. SAMPEX observed relativistic microbursts only when it passed right through the IPA. SAMPEX observed no other precipitation during this conjunction.

## 1.2 Figures





**Figure S1.** A map of the CARISMA magnetometers. Green dots show the magnetometers that observed the EMIC wave, and the green X where the EMIC wave entered the ionosphere. The blue triangle show the magnetometer that observed only broadband wave power (defined here by a > 1 Hz upper bound) with no clear EMIC wave. The black square shows where no EMIC or broadband waves were observed.



**Figure S2.** A step plot showing SAMPEX time series data during the conjunction. Panel a shows the 20-ms resolution, > 1 MeV electrons observed by HILT; Panel b shows the 100-ms resolution, > 400 keV electrons observed by PET; and Panel c shows the 1-s resolution, > 25 keV electrons observed by LICA's STOP microchannel plate. The width of each step corresponds to the instrument's cadence, and the minor ticks are at every second.