Supplementary Figures for "Rotationally driven magnetic reconnection in Saturn's dayside"

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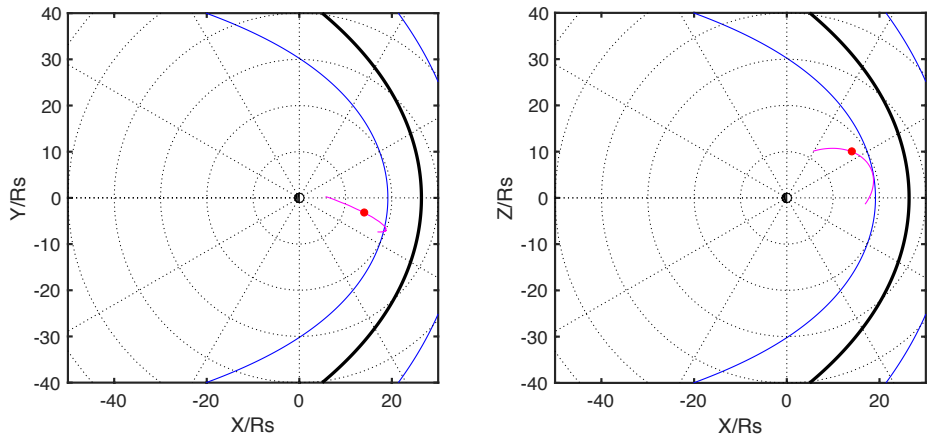
Supplementary Figure 1: Cassini position and trajectory in the Kronocentric Solar Magnetospheric Coordinates (KSM) during 2008. Magnetopause location (thick black curve) predicted using the A60 model[1] with improved parameters, while the solar wind dynamic pressure is estimated using the Tao model[2] (P_{SW} = 0.00906nP). The inner and outer curves (blue) bound the possible locations for the magnetopause using the root mean square errors of the A60 model coefficients. The magenta curve is the trajectory of the Cassini spacecraft between 2008-09-27/12:00 UT and 2008-10-01/12:00 UT. The red dot presents the position of Cassini when the event was observed, which demonstrates that the event occurred well inside the magnetosphere.

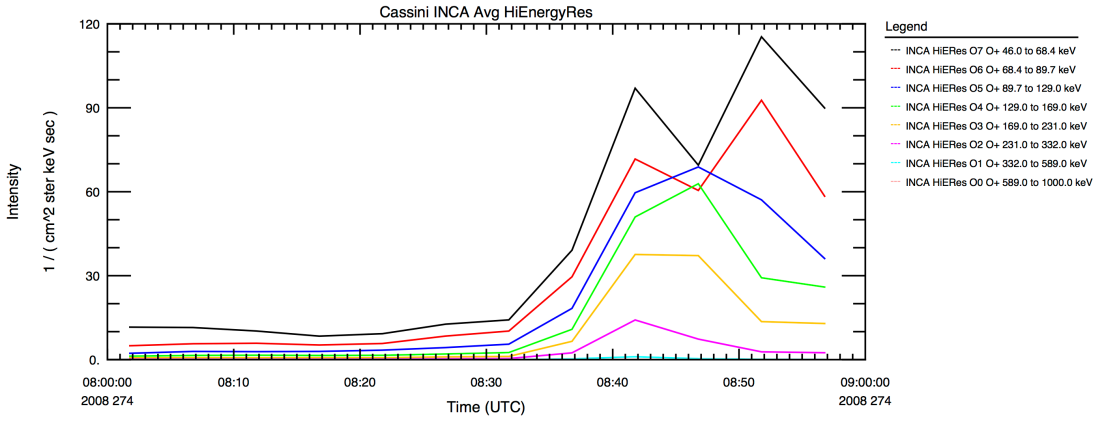


References

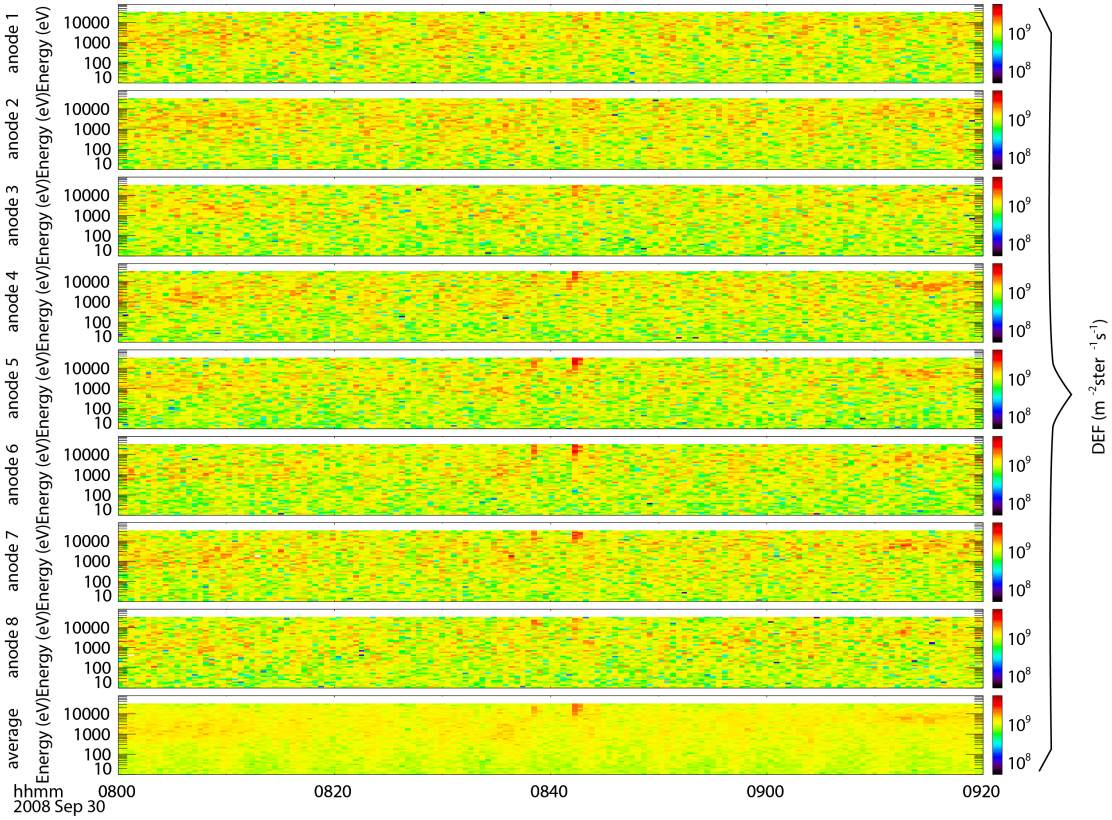
1 Kanani, S. J., et al., A new form of Saturn's magnetopause using a dynamic pressure balance model, based on in situ, multi-instrument Cassini measurements, *J. Geophys. Res.,* **115**, A06207 (2010).

2 Tao, C., Kataoka, R., Fukunishi, H., Takahashi, Y. & Yokoyama, T. Magnetic field variations in the Jovian magnetotail induced by solar wind dynamic pressure enhancements, J. *Geophys. Res*., **110**, A11208 (2005).

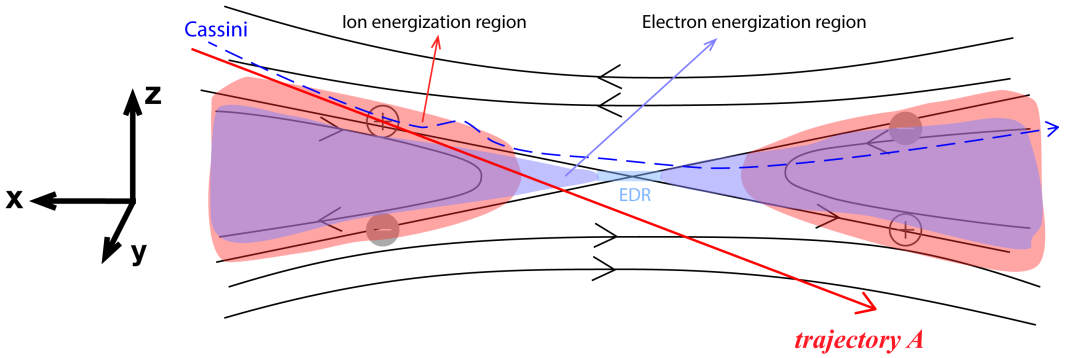
Supplementary Figure 2: The differential energy flux of O^+ for the energy from 46keV to 1MeV. The energies of the colored lines are shown in the legend. plots the Ion and Neutral Camera (INCA) intensity for 46 keV to 1 MeV for O+ with a time resolution of 5 minutes. A significant increase of O+ for energies larger than 300 keV occurs around 08:41 when Cassini entered the magnetic reconnection diffusion region.



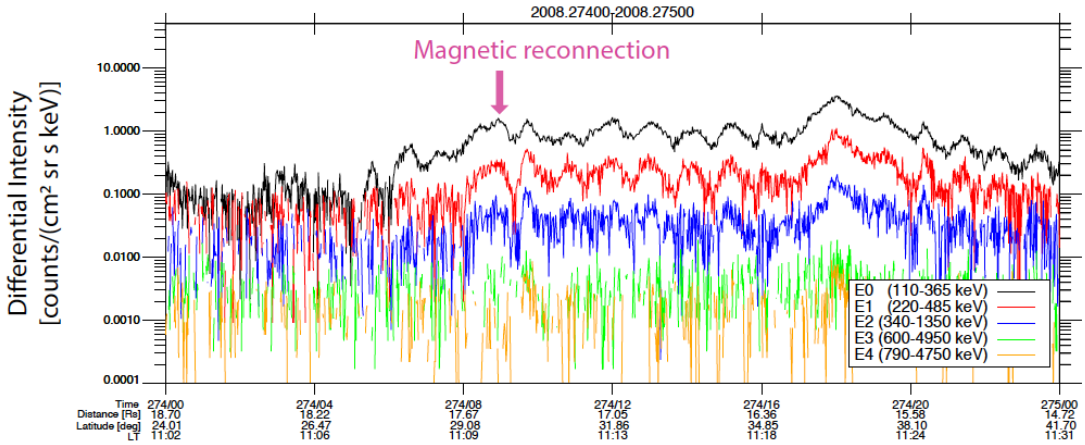
Supplementary Figure 3: The differential energy flux of ions for all anodes from CAPS-IMS. From top to bottom are the flux from anode 1 to anode 8, and the average of all anodes.



Supplementary Figure 4: Illustration of the heated ions and electrons domains. The light blue rectangle at the center presents the electron diffusion region. The red shadows present the domain where hot ions can be detected, and the blue shadows are for electrons. The plus and minus symbols present the polarities of the Hall magnetic field B_Y. The dashed blue curve illustrates trajectory of Cassini. If we assume in other situations a spacecraft travels along the red solid line, very different features may also be observed.



Supplementary Figure 5: Quasi-periodic relativistic electrons injections events observed by MIMI_LEMMS. The purple arrow indicates the time when Cassini encounter the reconnection site. The enhancement recorded by E0 channel implies that the reconnection process could have been triggered before the diffusion region was detected. The quasi-periodic enhancements recorded by E0-E2 occur just after the encounter of negative B_θ at ~8:40 and last for more than 14 hours. This might be because the reconnection process became unsteady and the reconnection rate changed periodically.



Supplementary Figure 6: Sketch of the location of the reconnection region inside the Saturn's magnetosphere. The reconnection occurs in the dayside magnetosphere, apart from the magnetopause. Please note that the sketch just shows the relative position of the reconnection site, not present the real ratio the reconnection site to the magnetosphere.