

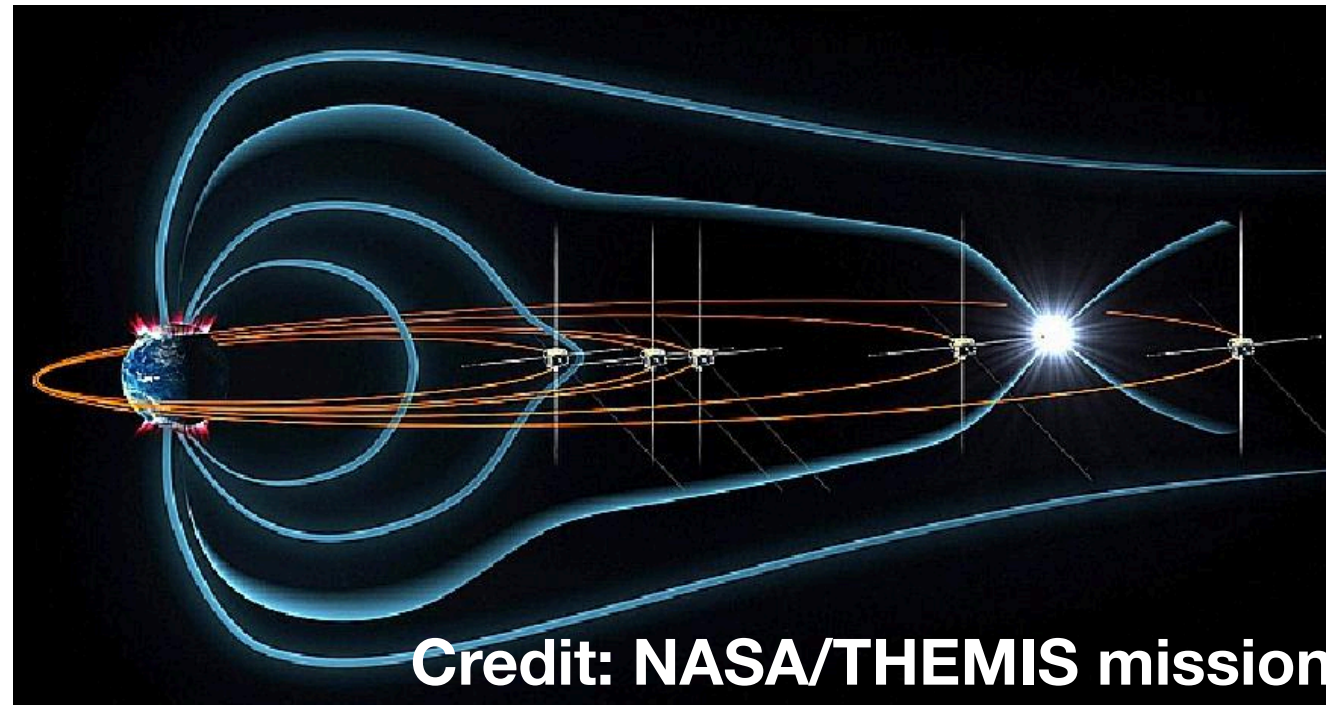
Recent advances on magnetic reconnection and dipolarization at Saturn

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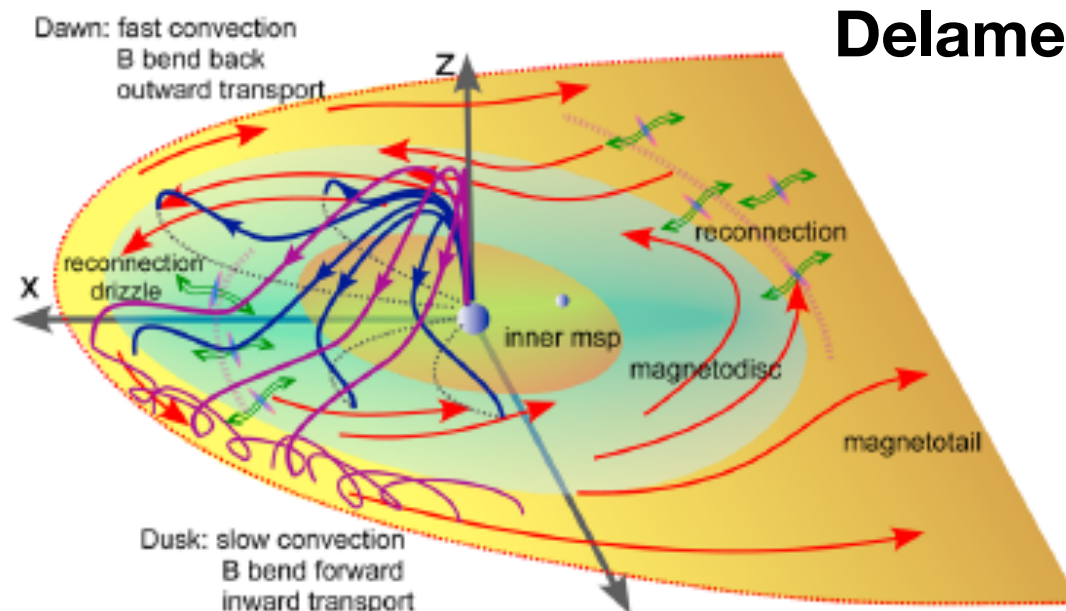
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STAR institute, Université de Liège, Liège, Belgium

Is it possible that magnetic reconnection site or dipolarization site co-rotates with Saturn?



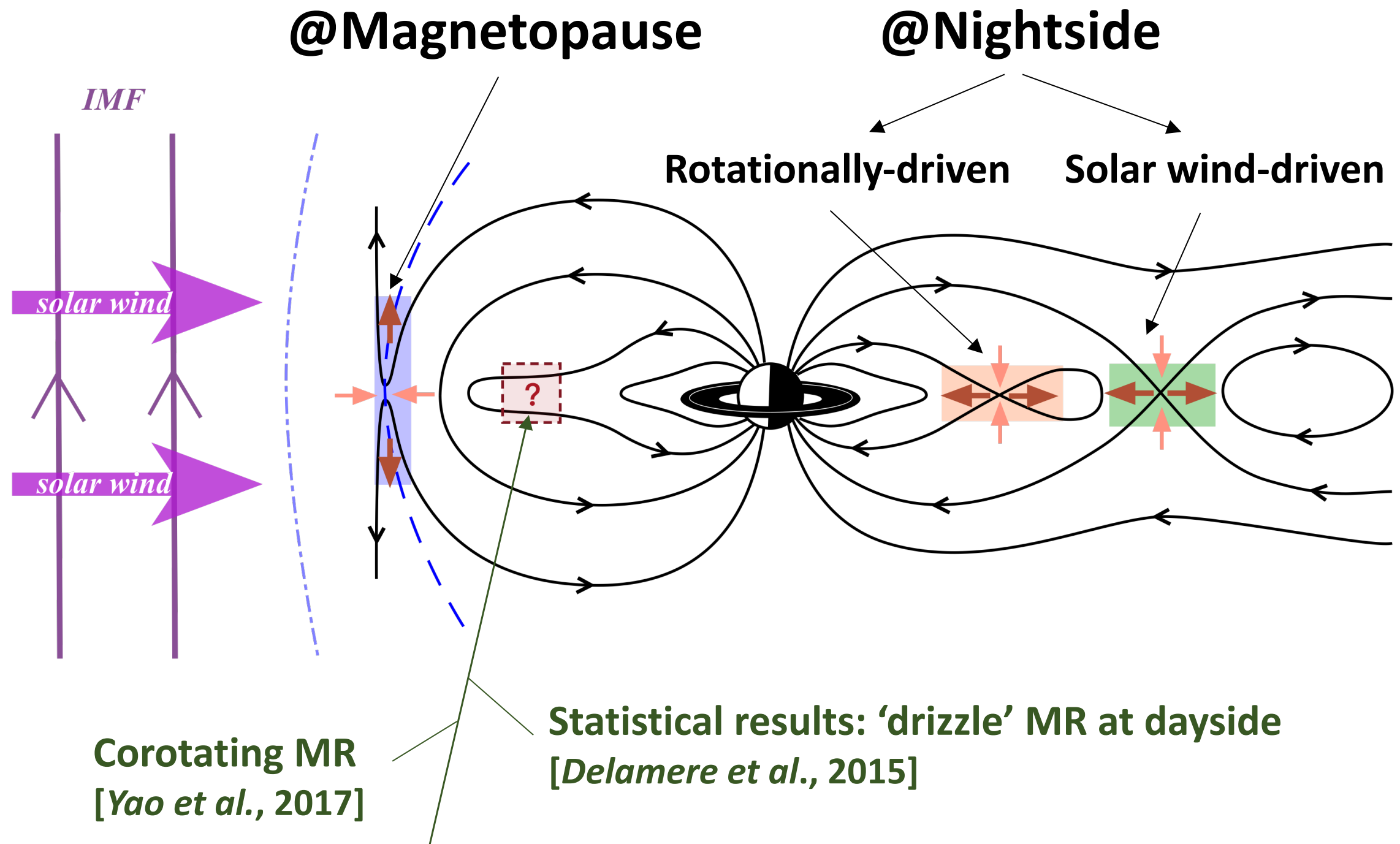
Due to solar wind interaction, **only the nightside** magnetosphere is stretched, and therefore favourable for reconnection to occur.



Delamere+ *JGR*, 2015

~1000 Btheta negative events (indirect reconnection evidence) were identified in the **dayside magnetosphere**.

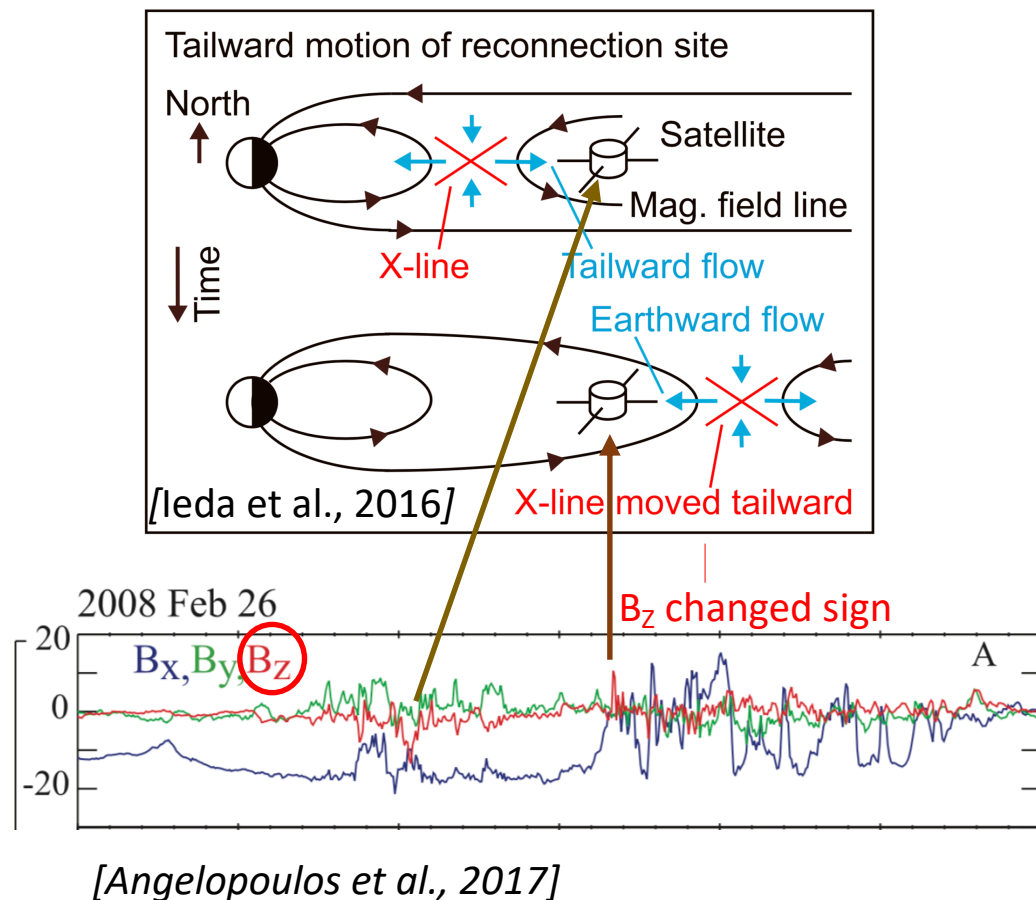
MOTIVATION: Reconnection Sites on Saturn



Evidence of the Dayside Magnetodisc Reconnection (DMR)?

Corotating Magnetic Reconnection Site

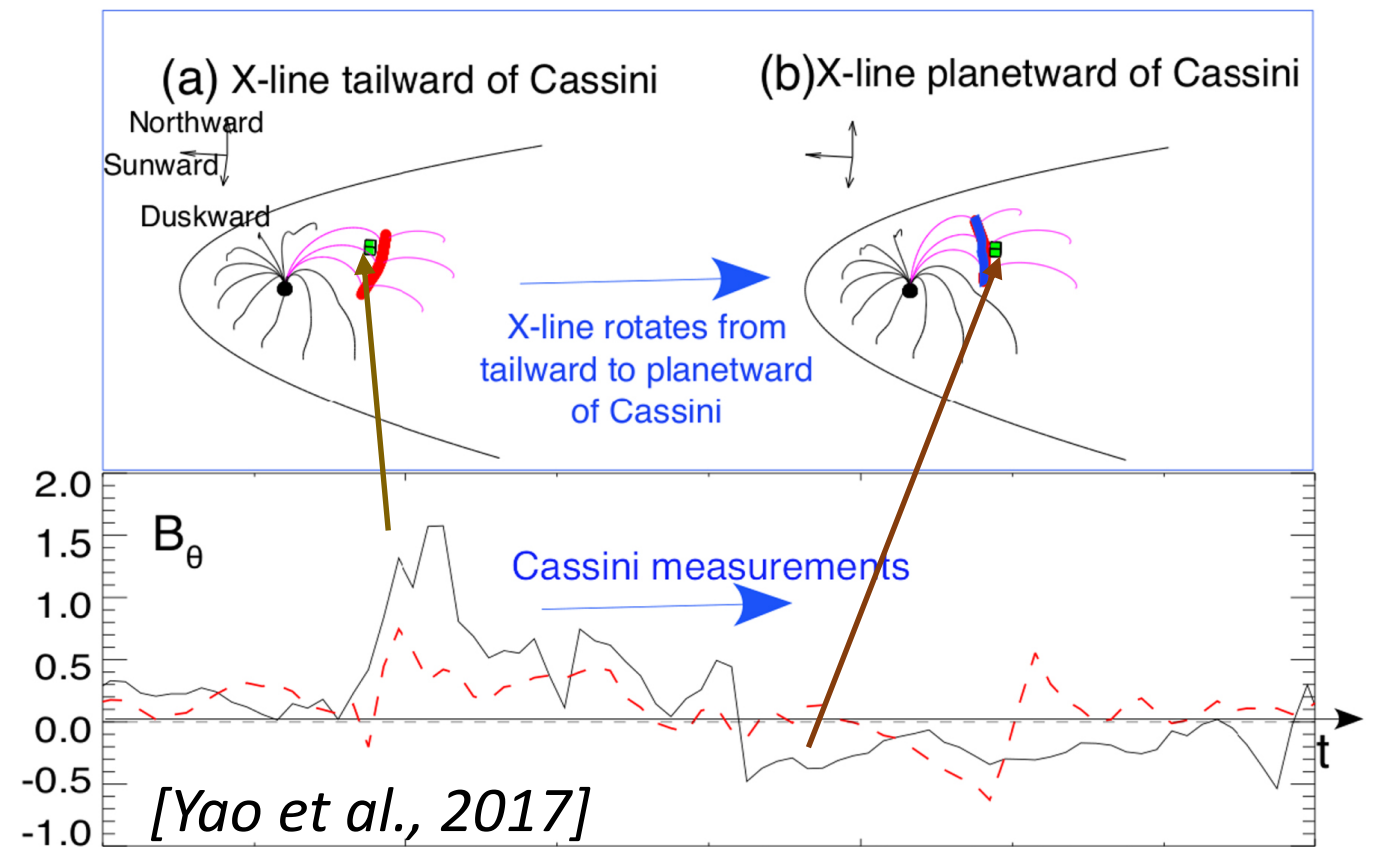
Observations on Earth



At Magnetotail, spacecraft crosses the reconnection site due to the radially movement of the X-line.

Observations on Saturn

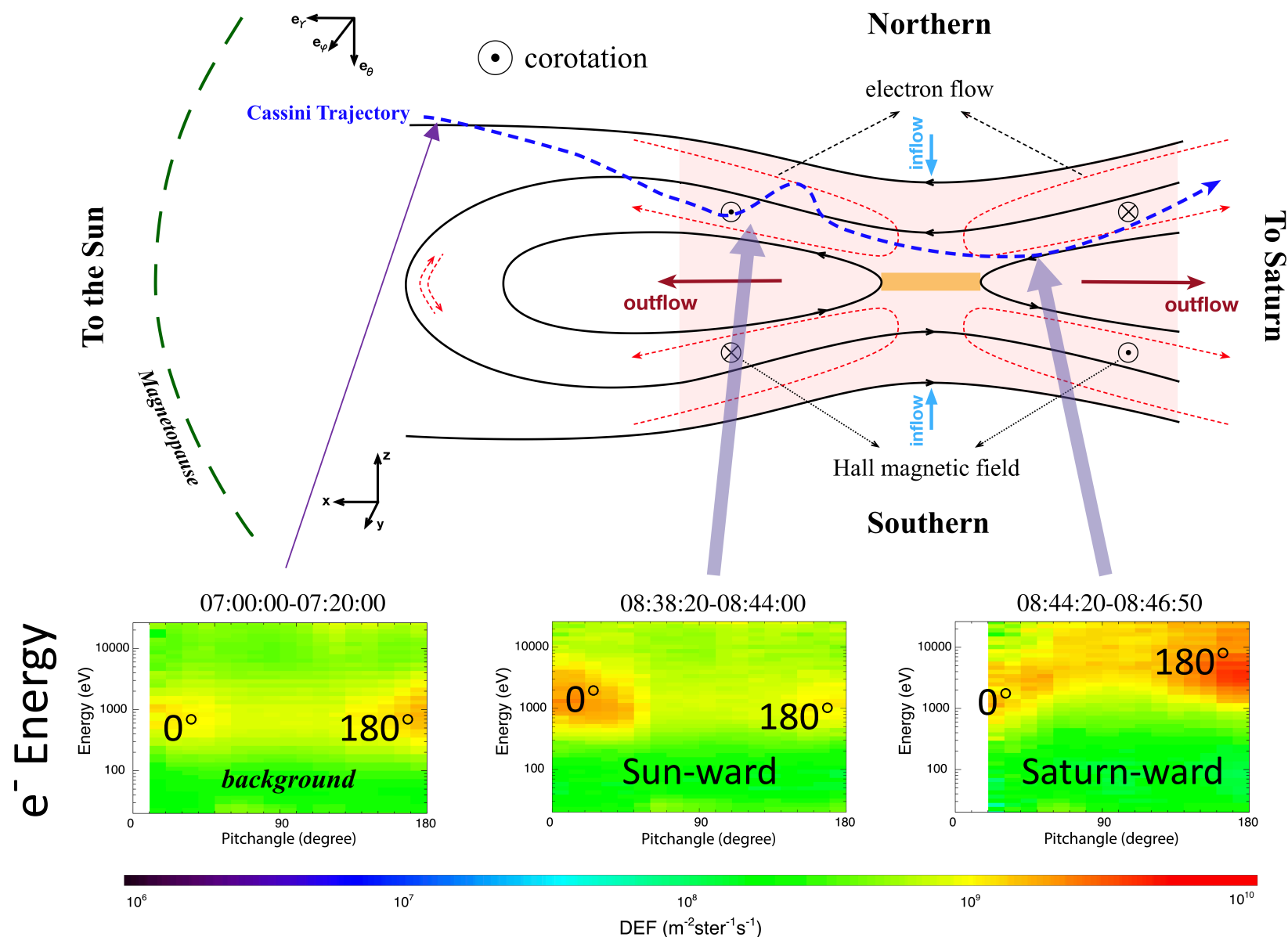
- ✓ X-line **moves azimuthally** to let Cassini cross the reconnection site.
- ✓ The reconnection site is recorded again after one rotation period.



Red dashed line: after one rotation period, Cassini crossed the X-line again.

Direct MR Evidence: Diffusion Region

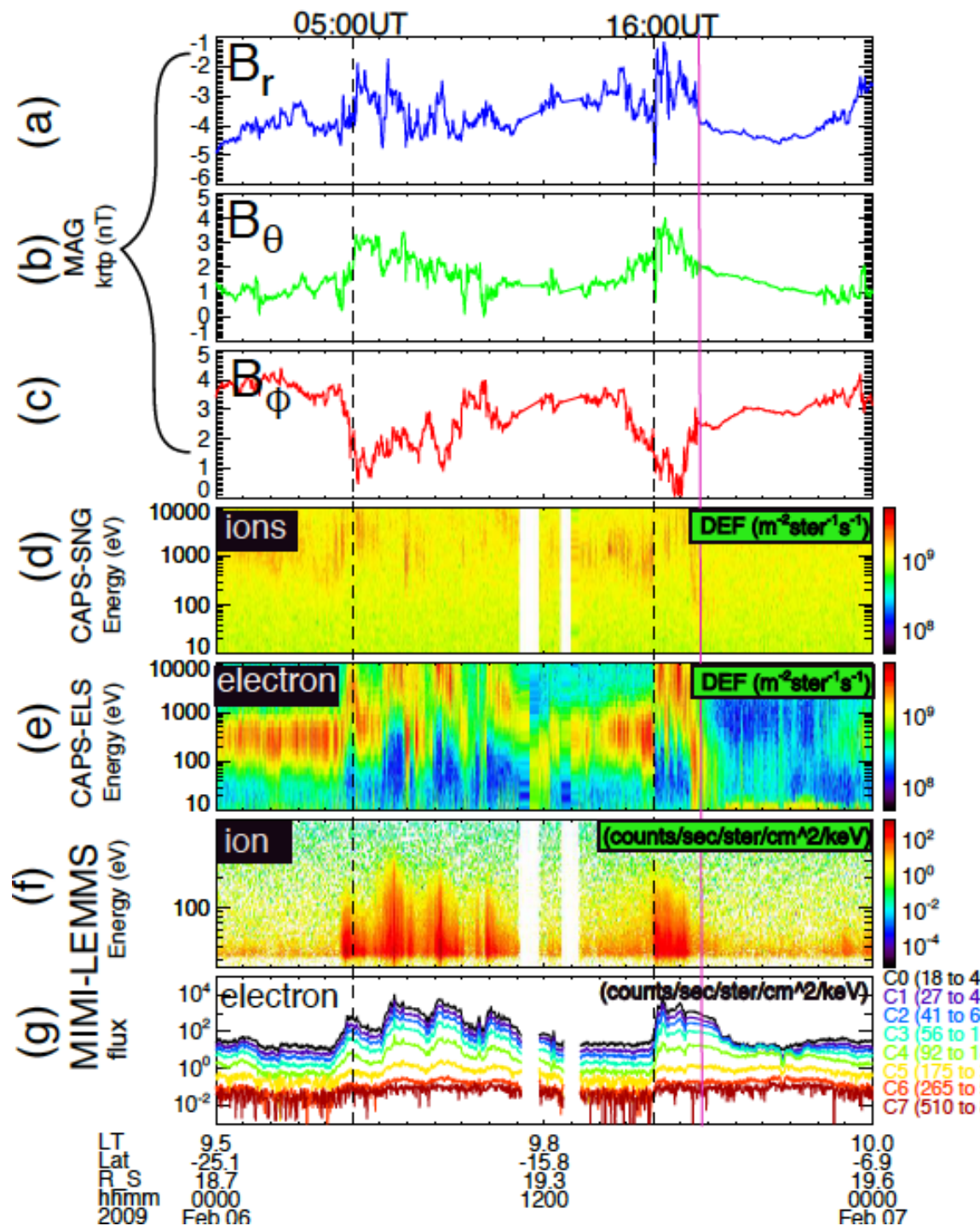
- ✓ **Background:** bi-directional electrons \rightarrow closed field lines
- ✓ **Sun-ward of X-line:** higher energy e^- leaves (0°) & *lower* energy goes *into* (180°) X-line
- ✓ **Saturn-ward of X-line :** higher energy e^- leaves (180°) & *lower* energy goes *into* (0°) X-line



[Guo, Yao et al., 2018, Nature Astronomy]

Dipolarization at Saturn's dayside and corotates

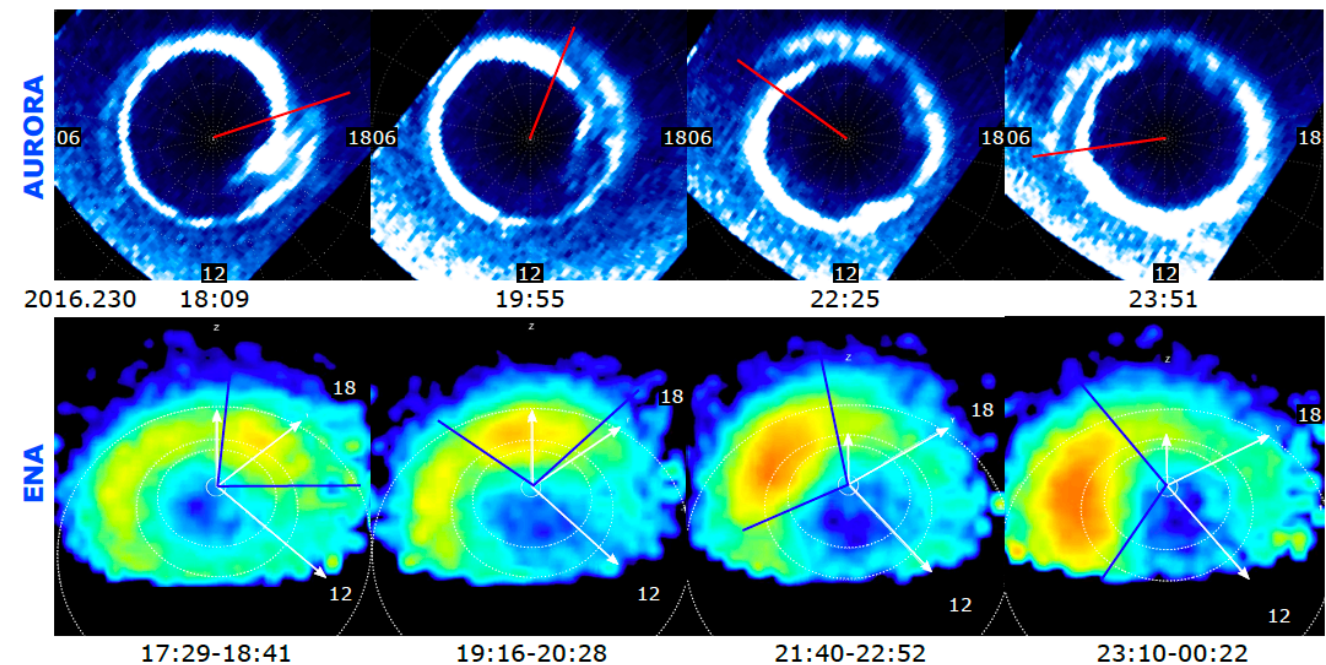
Yao et al., JGR, 2018



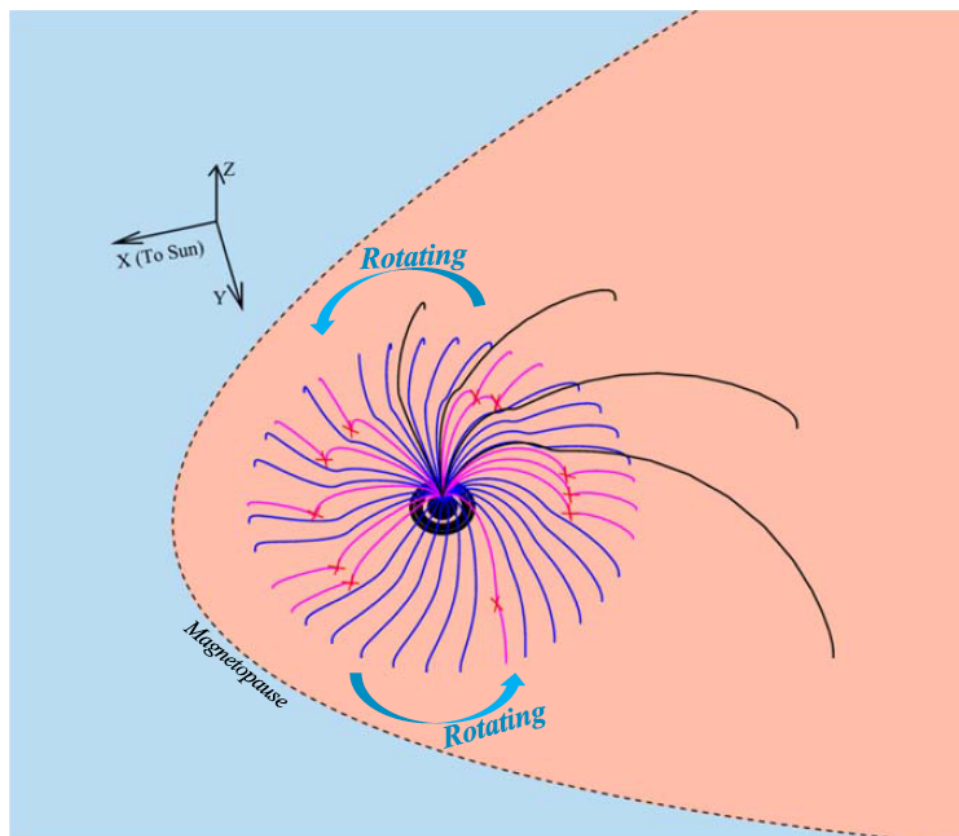
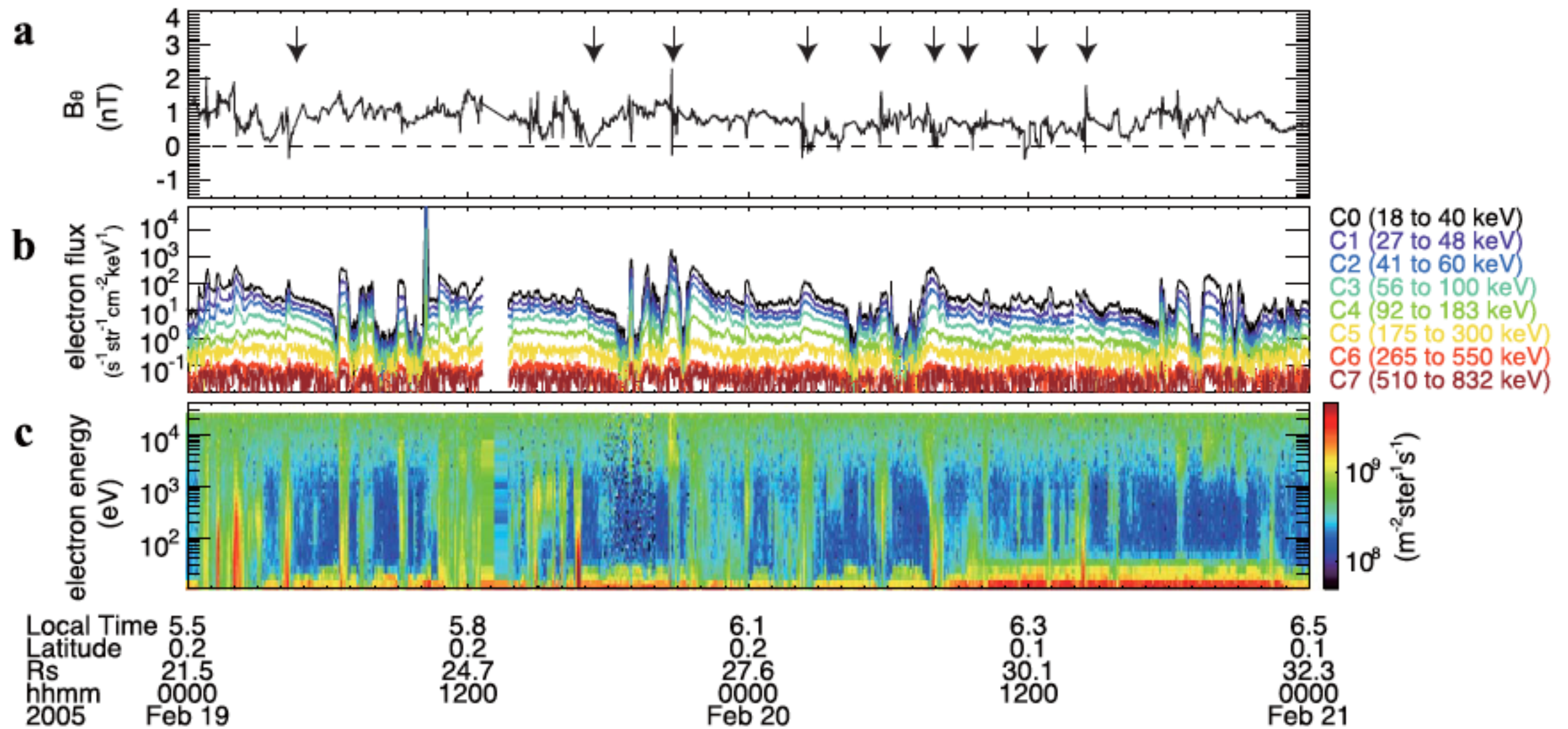
- Magnetic dipolarization exists at dayside
- Dipolarization could recur after one planetary rotation
- Electrons and ions are accelerated to ~100 keV.

It is unclear why dipolarization recurred?
(re-occur, or rotate back to the spacecraft?)

Palmaerts et al. 2020, in preparing



Aurora and energetic particles are corotating!



Traditional reconnection picture:

- * nightside
- * tailward retreating

New picture:

- * all local time (no strong LT dependence)
- * corotating (or rotating)
- * drizzle-like small scales

A brief summary of key updates

- Reconnection and Dipolarization at dayside magnetodisc
- Reconnection and Dipolarization rotate with Saturn
- Reconnection sites are drizzle-like

