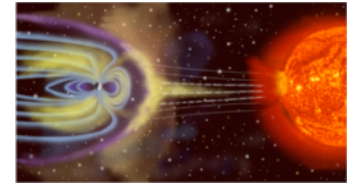
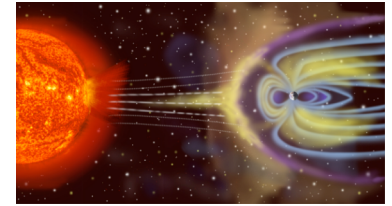


Substorm Cold Plasma Ejections

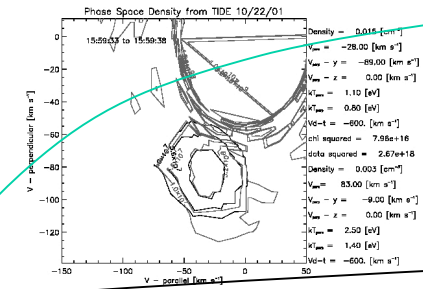
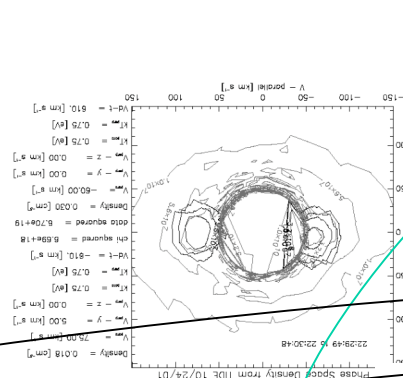


- T. E. Moore, S. Christon, S. Chen, J Goldstein
- Synopsis:
 - Polar's visit to the nightside plasma sheet with apogee (9.5 RE) near equator produced a new category of event
 - Bursts of cold plasma seen to be ejected away from Earth
 - Precedes substorm hot plasma injection front arrival
 - Believed related to plasmaspheric dynamics in substorms
 - Suggests that the injection-dipolarization begins at a particular site as a 1 Re amplitude oscillation
 - May reflect reconnection-driven BBF shedding vortexes?
 - May indicate a local instability?

Plasma Sheet Velocity Distributions

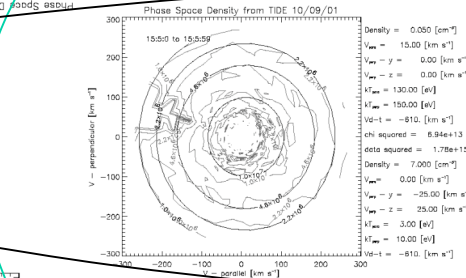


Bi-streaming
Anisotropy



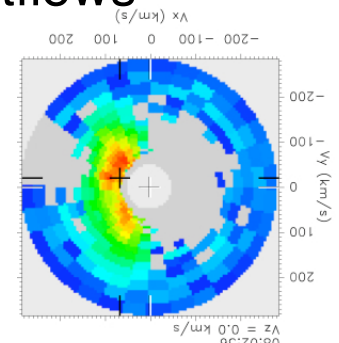
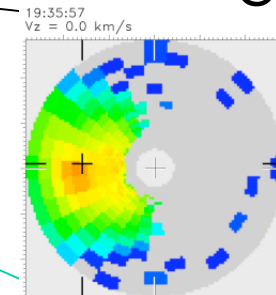
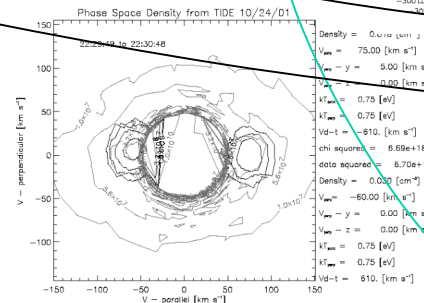
Lobal
Wind

Hot
Isotropic



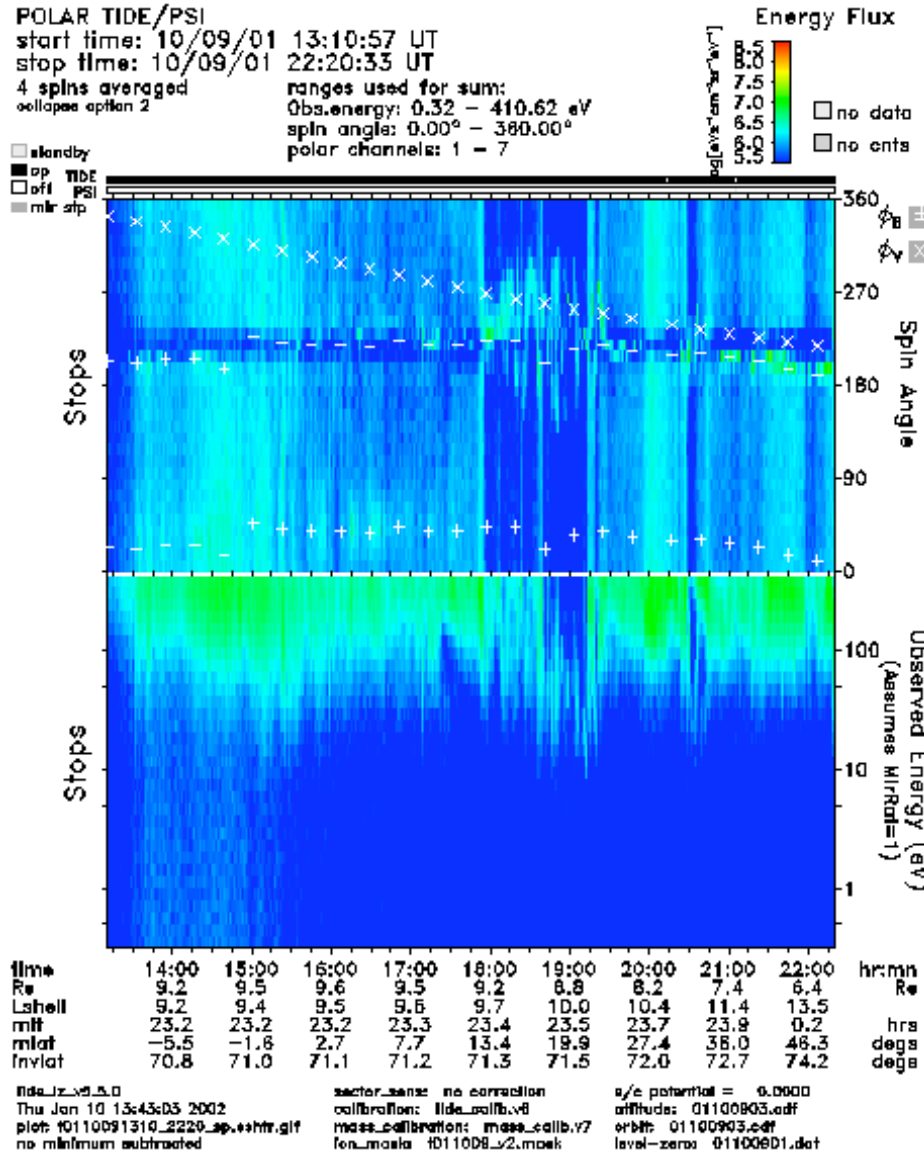
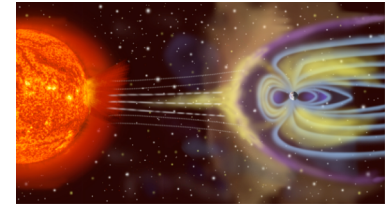
Auroral
Outflows

Bi-streaming
Anisotropy

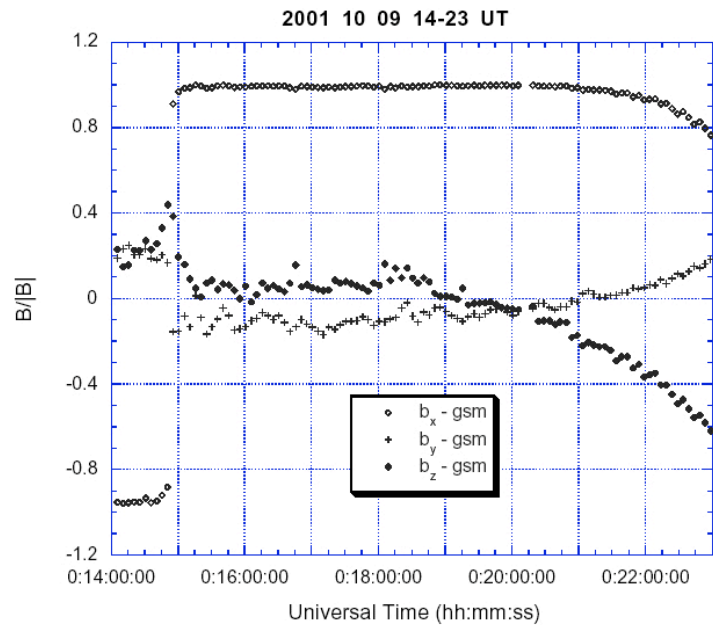


TIDE Telecon
2005/05/03

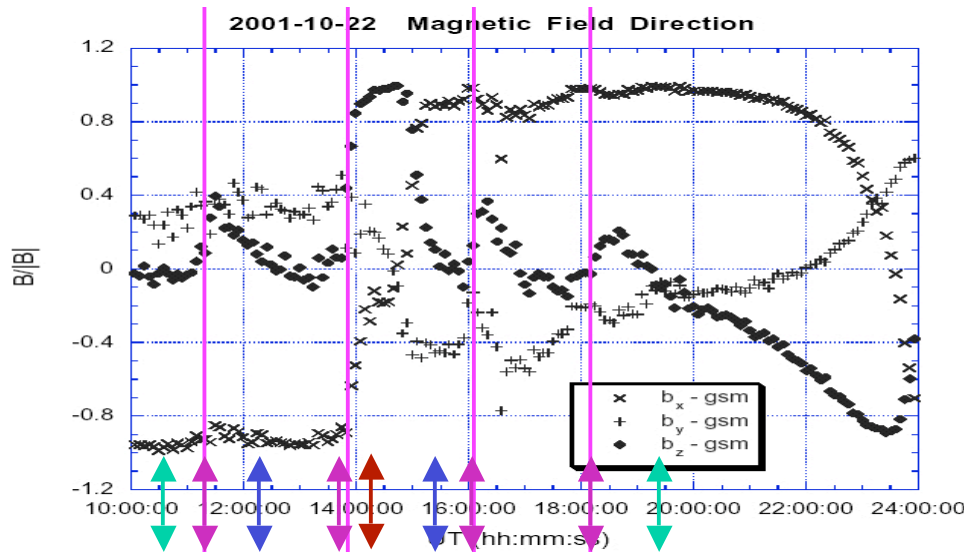
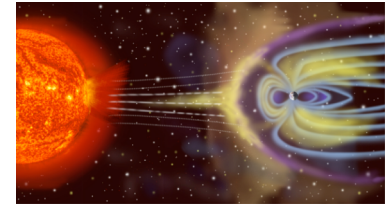
Active Thin Plasma Sheet



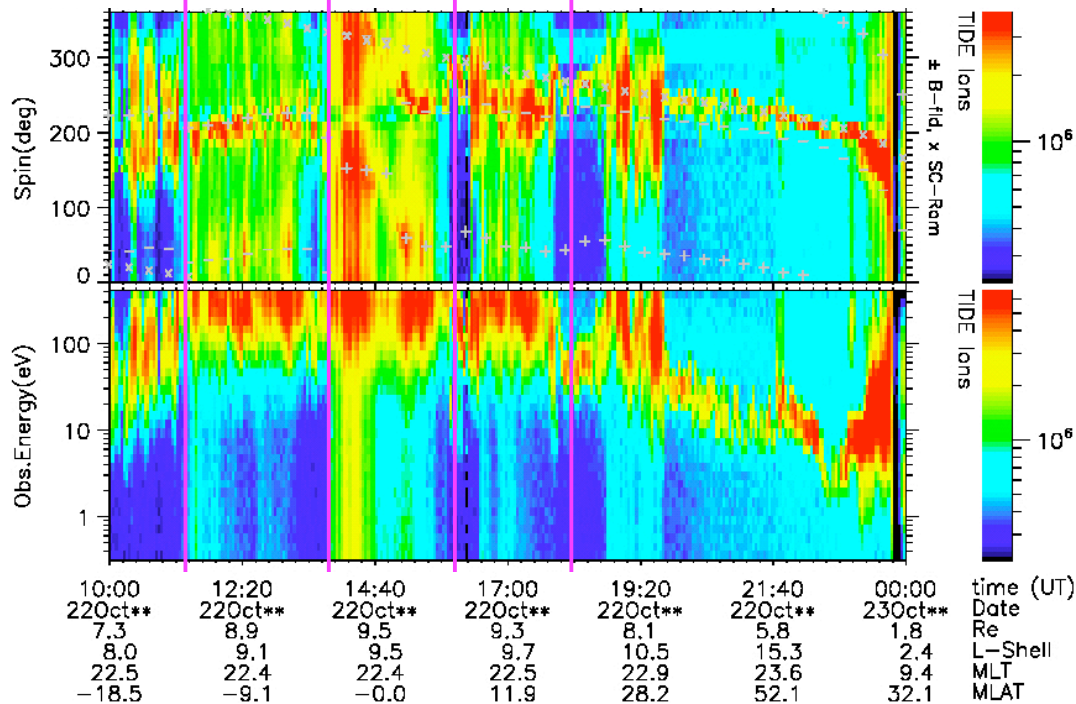
- Neutral sheet crossing left.
- Bi-directional streaming left center
- Auroral outflows right center
- “Lobal Wind” at right
- Current sheet “eruption”?



Plasma Sheet Structure w/ Substorms

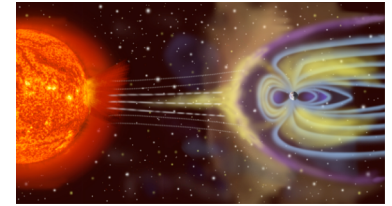


E Ion Density



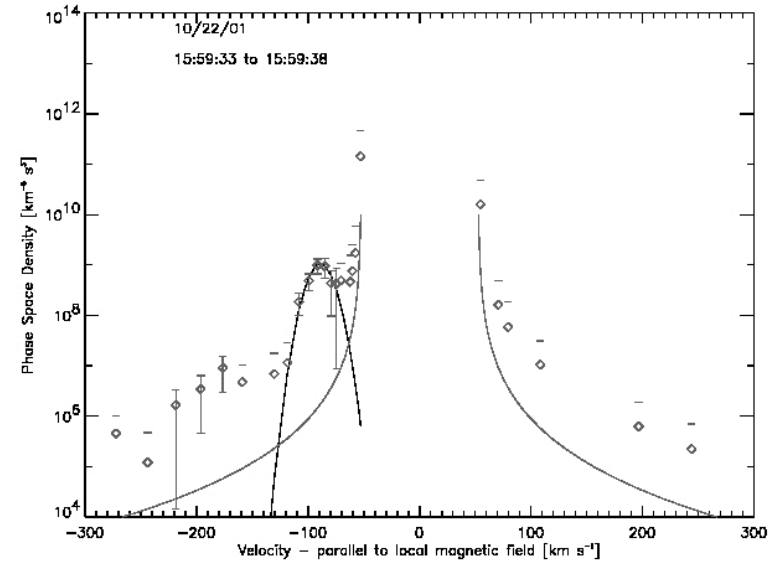
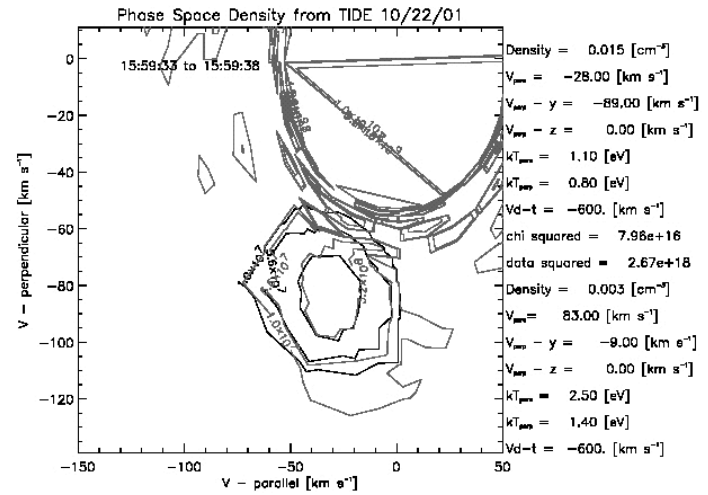
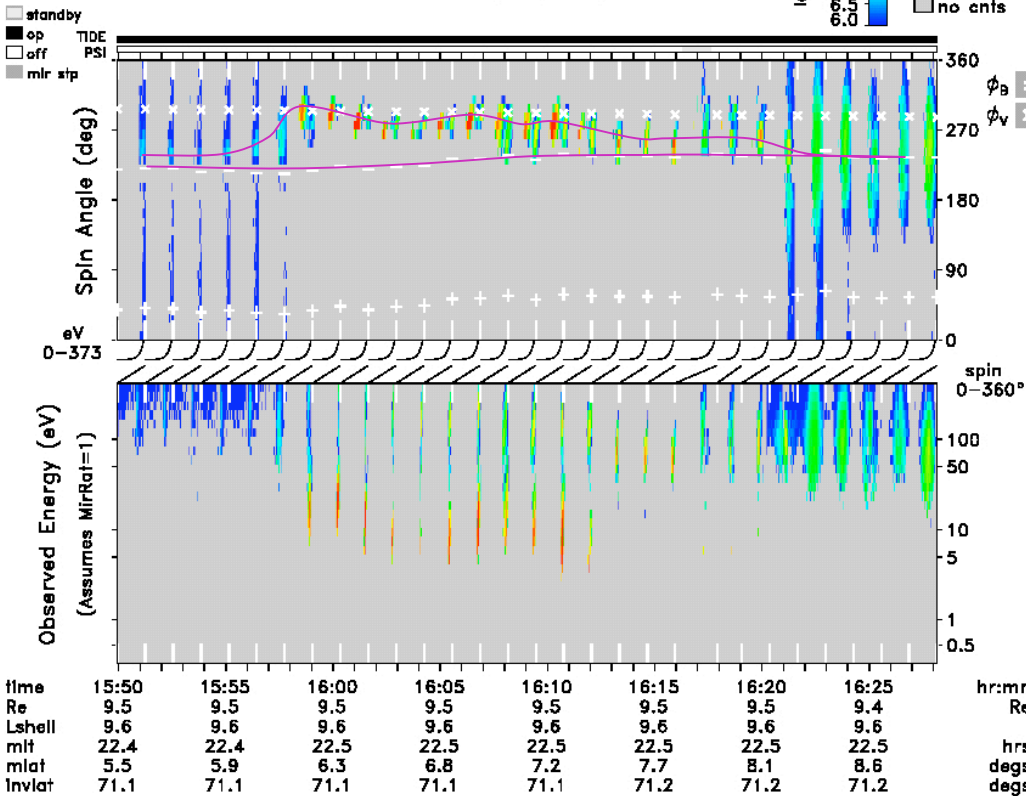
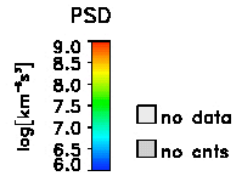
- Lobal wind threads entire pass.
- Auroral heating processes observed next to lobe
- Bidirectional streaming either side of neutral sheet
- Hot component mixed with bidirectional streams
- Isotropic hot plasma at neutral sheet
- Bz shows series of dipolarization events.
- Excursions into lobe (cold lobal wind), and back into plasma sheet.
- Lobal wind exceeded by drift toward neutral sheet

Lobal Wind Streams in Dipolarization

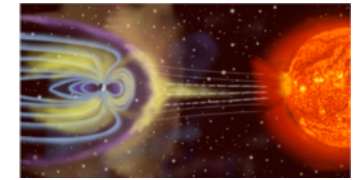


POLAR TIDE/PSI
 start time: 10/22/01 15:49:57 UT
 stop time: 10/22/01 16:29:04 UT
 13 spins averaged
 collapse option 2
 spin marker at sun pulse

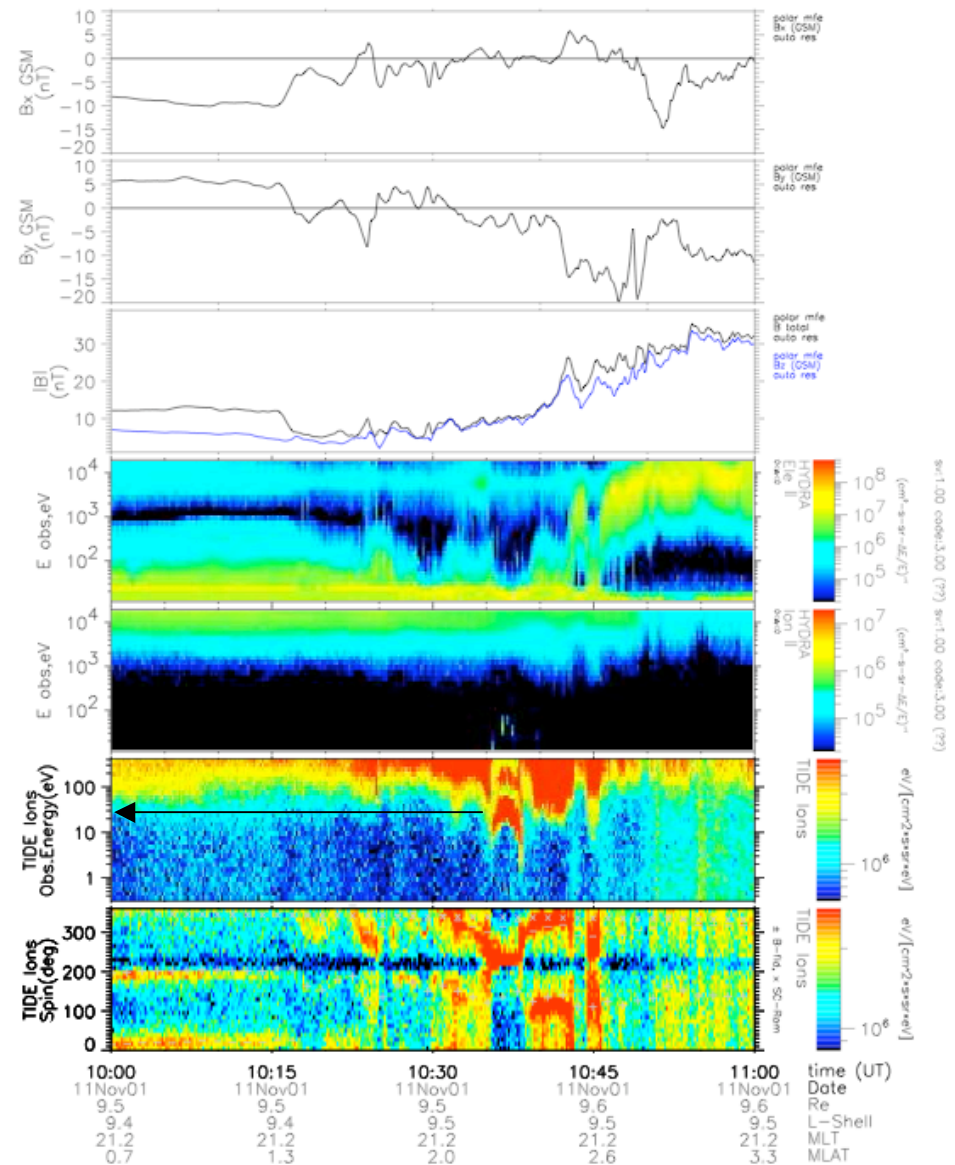
Stops(H⁺)



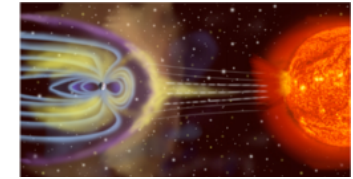
Substorm Cold Plasma Ejections



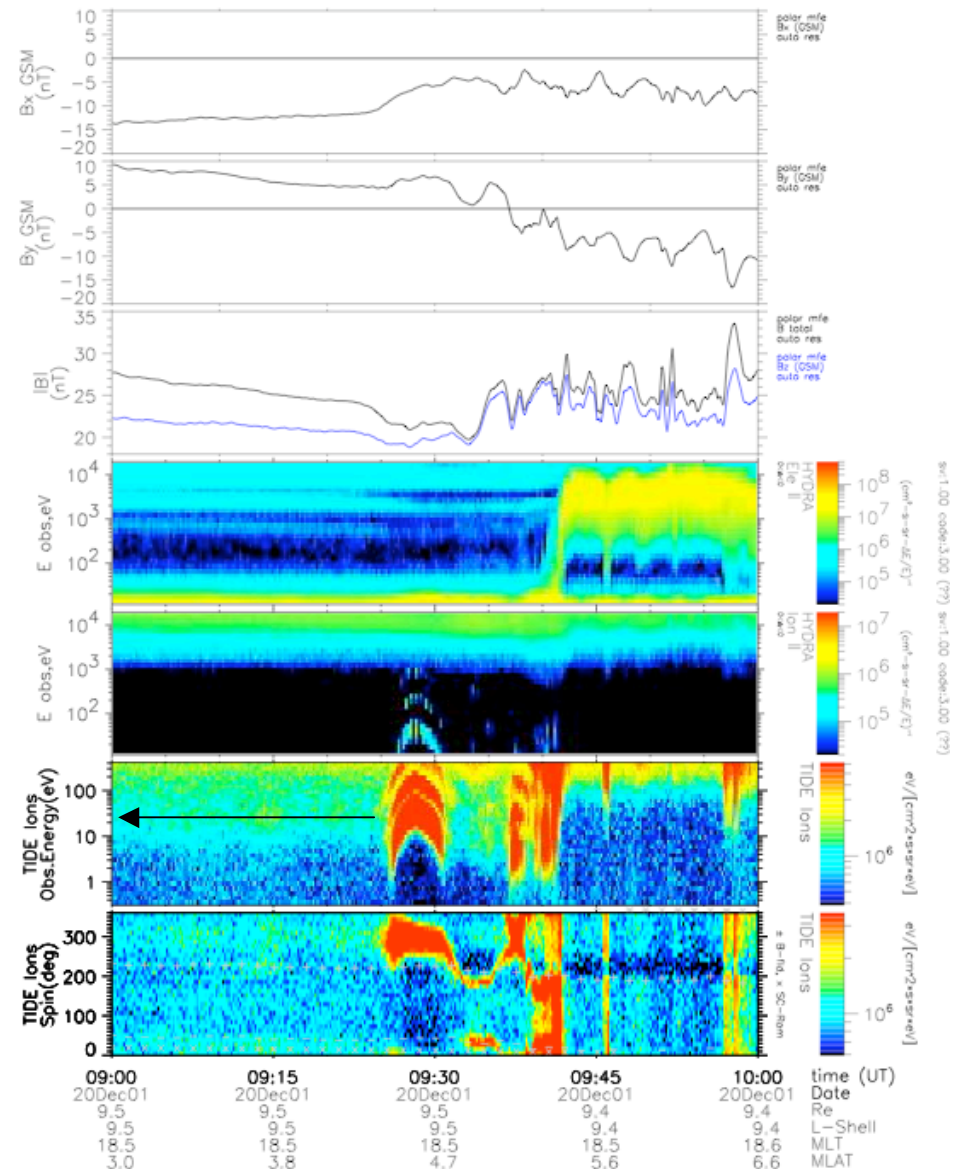
- Substorm Injection 11 Nov 2001
- Polar at 9.5 RE, 21.2 MLT
- Begins with bidirectional streaming
- A wavelike disturbance begins 30 min prior to the local hot plasma injection
- Continues until the local dipolarization/injection
- Lowest energy, highest flux in outward burst.
- ~20eV H+ ~ 50 km/s 180s, displacement ~ 1.5 RE



Substorm Cold Plasma Ejections

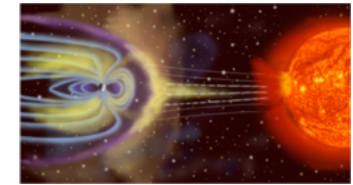


- Substorm Injection 20 Dec 2001
- Polar at 9.5 RE, 18.5 MLT
- Begins w/o bidirectional streams
- A wavelike disturbance begins 15 min prior to the local hot plasma injection
- Alternates outward bursts with bidirectional streams
- Lowest energy, highest flux in outward burst.
- ~20eV H+ ~ 50 km/s 180s, displacement ~ 1.5 RE



Velocity Distributions 18:30

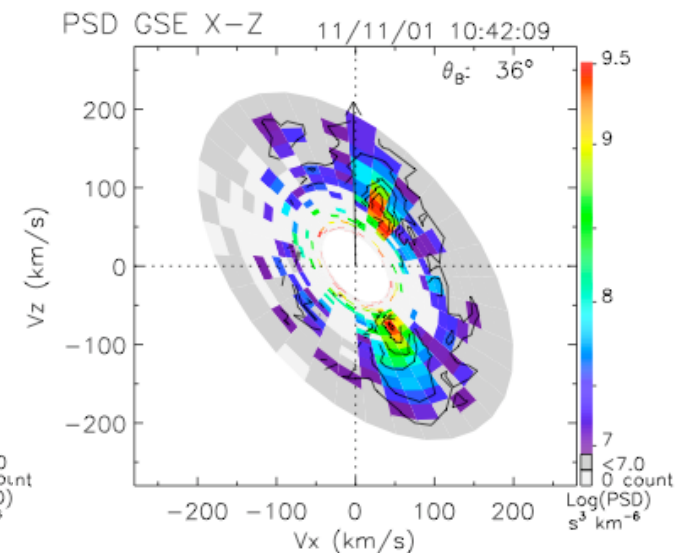
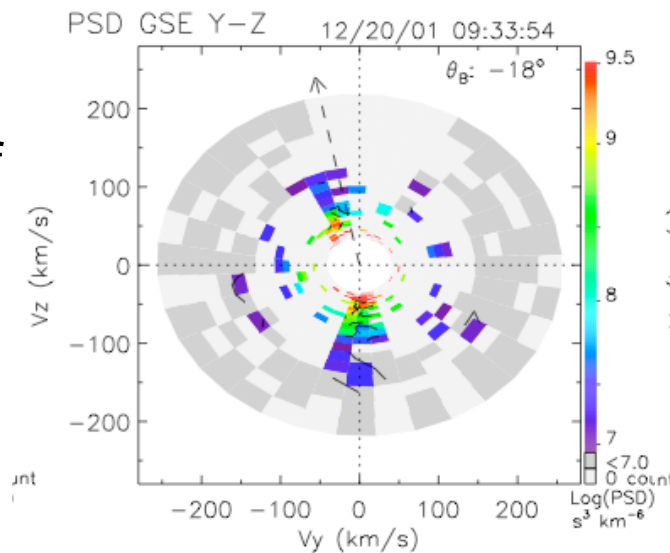
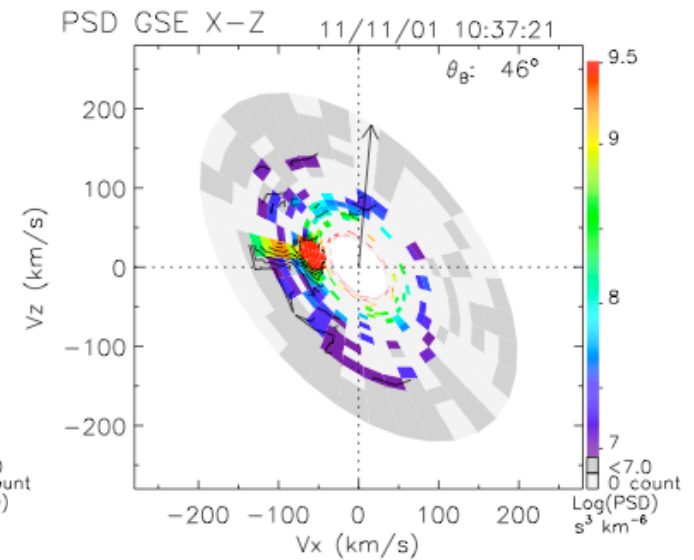
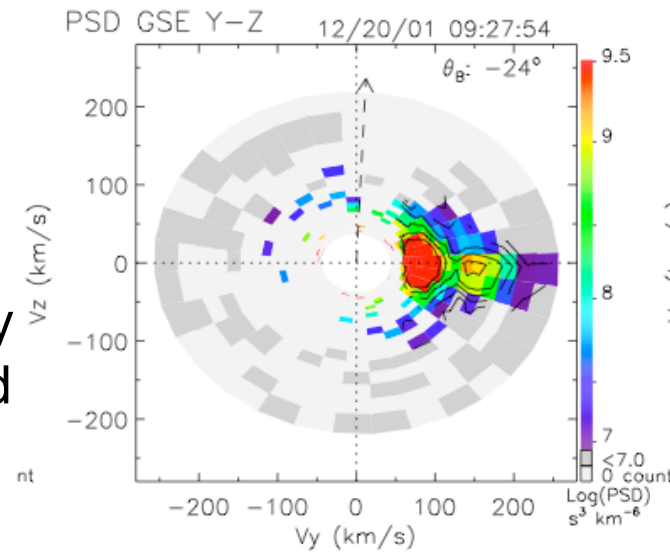
21:10



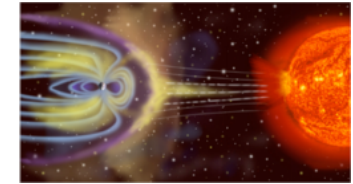
- ULF radial oscillations

- Cold stationary during outward half cycle

- Bidirectional stream during Earthward half cycle

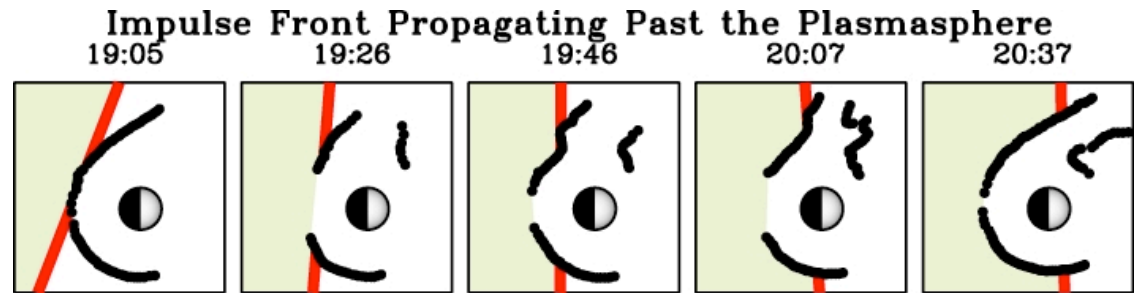


IMAGEing Propagating Injection Fronts

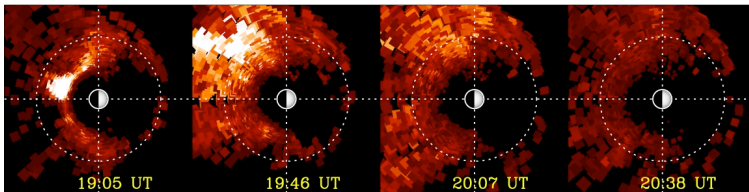


- Right: 17 April 2002 substorm imaged in FUV electron auroral precipitation (mapped), HENA proton pressure, and EUV flux (cold helium).
- Below: Vector flow from P-pause motion.

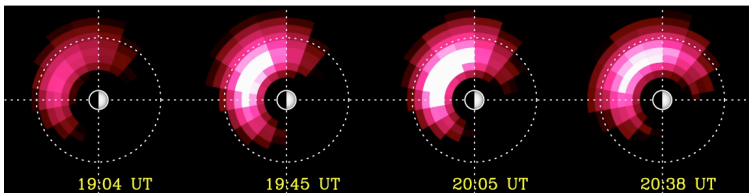
Courtesy of J. Goldstein



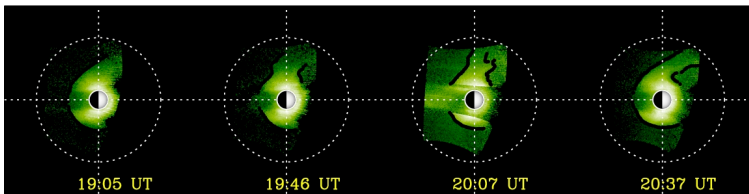
Electron Auroral Plasmasheet: Substorm



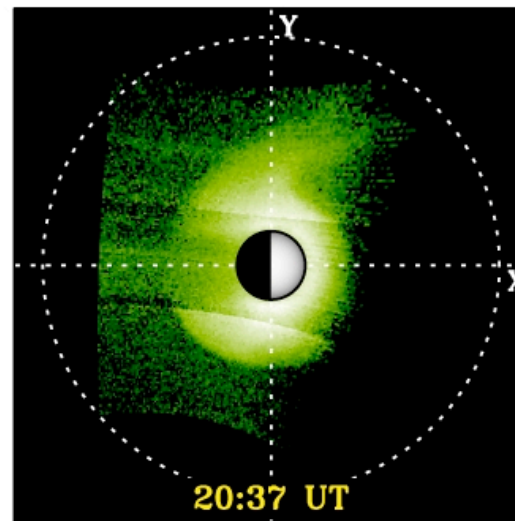
Proton Ring Current: Injection



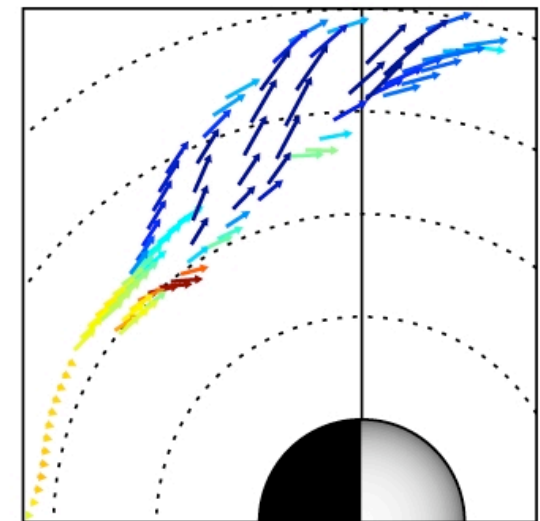
Helium Plasmasphere: Ripple/Undulation



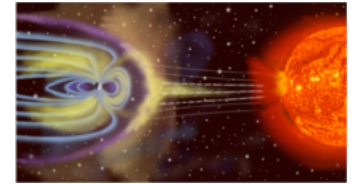
EUV Plasmasphere Image



Deduced Flow

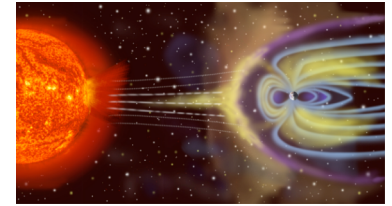


Plasma Ejection or Injection Front?



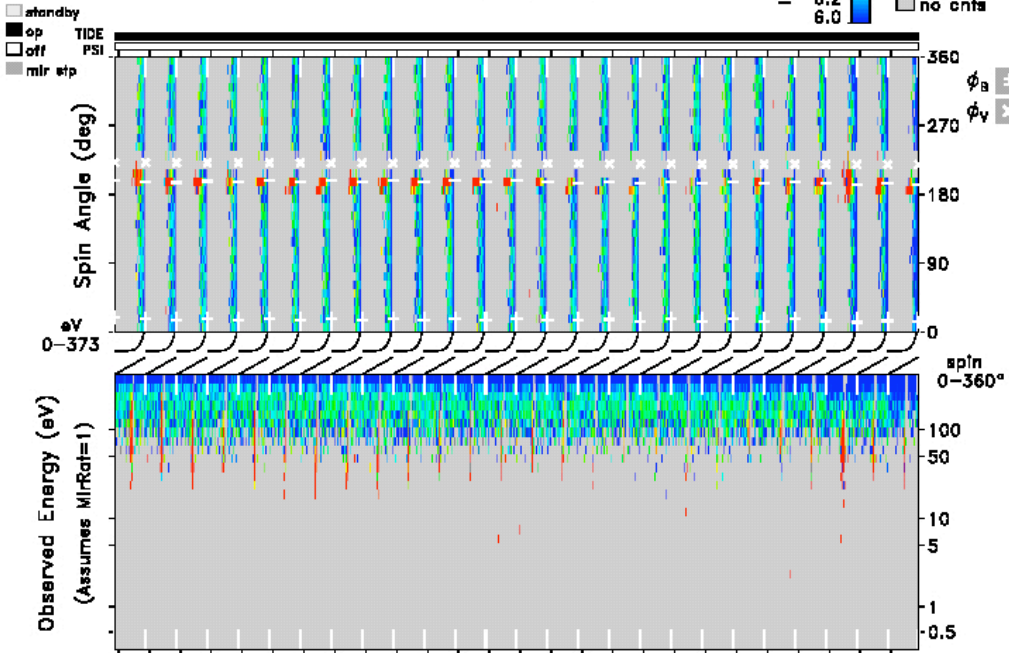
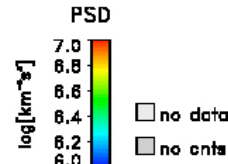
- Discussion
 - Low occurrence suggests Polar must be near equator,...
 - And near apogee at substorm onset
 - Corresponds closely with hot electron injection
 - Ejection may be related to injection motion at later MLT
 - An outer manifestation of the plasmopause ripple?
- Conclusions
 - Substorm injection events begin with growing ULF wave
 - Cold plasma is ejected as part of the wave growth
 - Culminates with familiar plasma injection as at geosync.
 - Observation at 9.5 Re consistent with extended front

Lobal Wind Streams -> Hot Plasma

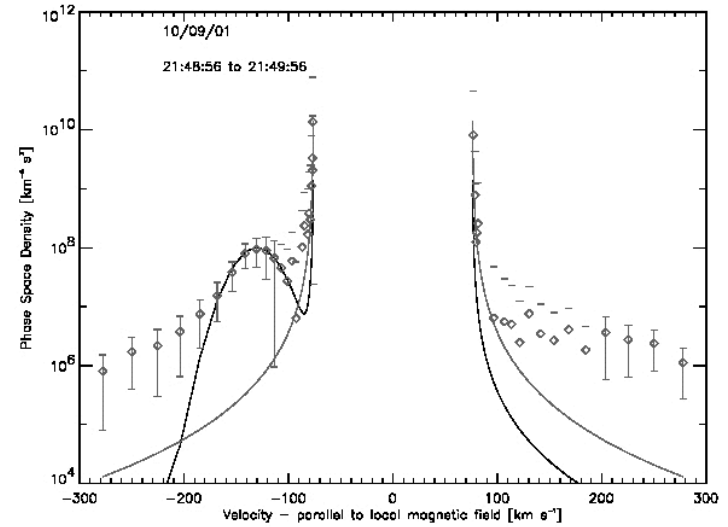
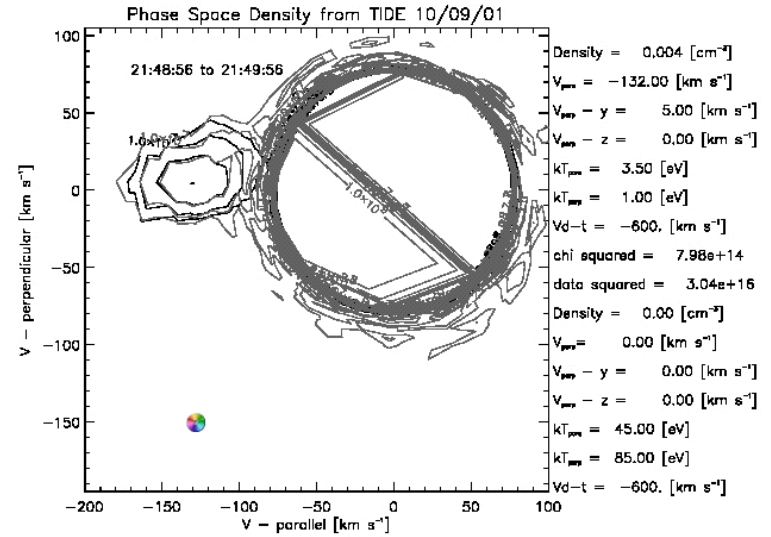


POLAR TIDE/PSI
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 stop time: 10/09/01 21:57:57 UT
 5 spins averaged
 collapse option 2
 spin marker at sun pulse

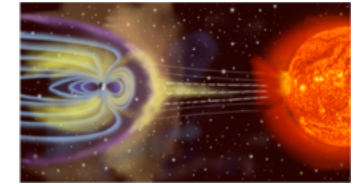
Stops(H+)



time	21:46	21:48	21:50	21:52	21:54	21:56	hr:mn
Ra	6.7	6.6	6.6	6.6	6.5	6.5	Ra
Lshell	12.8	12.9	13.0	13.1	13.2	13.3	
mlt	0.1	0.2	0.2	0.2	0.2	0.2	hra
mlat	43.7	44.1	44.4	44.8	45.2	45.6	degs
mlnat	73.8	73.8	73.9	73.9	74.0	74.1	degs

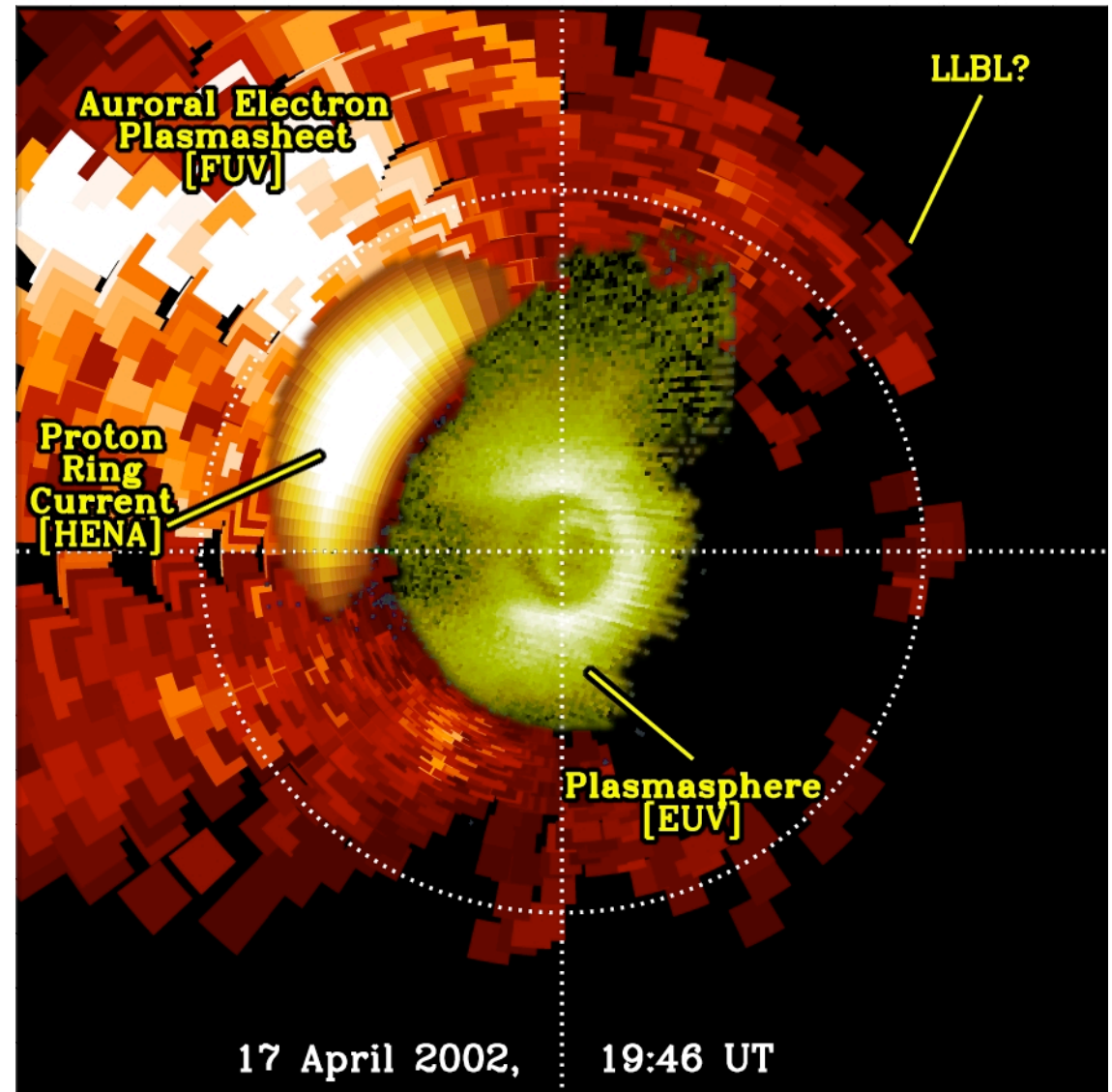


IMAGEing Propagating Injection Fronts



- Composite Snapshot
 - Plasma sheet electrons mapped from FUV aurora
 - Proton ring current HENA
 - Plasmasphere from EUV

Courtesy of J. Goldstein



Plasma Sheet Velocity Distributions

