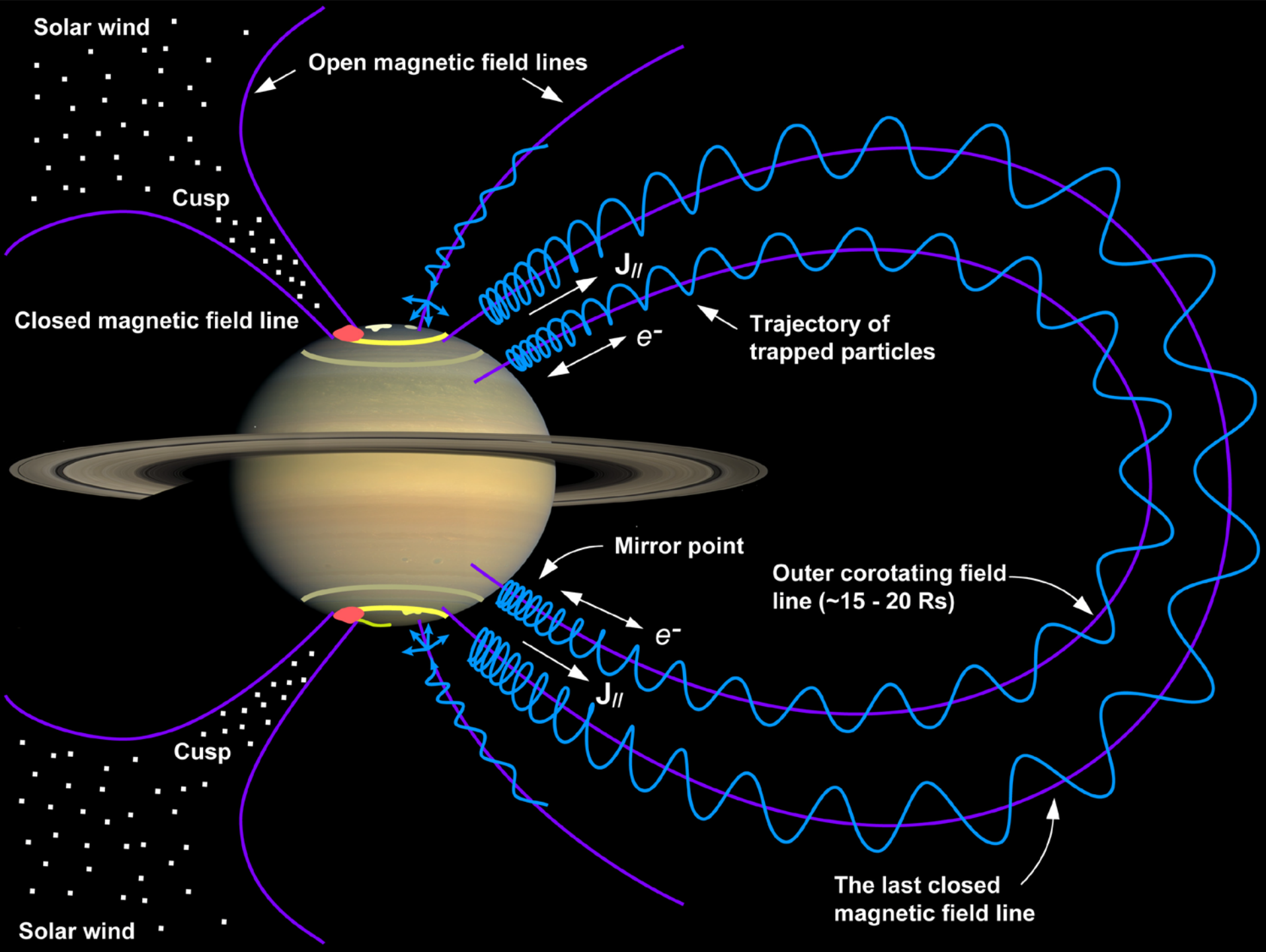


CHARM:
MAPS highlights 2010.

- Current systems and dynamic flow within the Magnetosphere
 - Largely Intangible (except to CAPS)
 - Largely Invisible (except to the MIMI instrument)
- The aurora – more than just pretty, presents an ‘inverted image’ of what’s going in on the magnetosphere
- This year, MAPS made progress deciphering the signatures of the aurora – raising more questions by the end of the year



Discovery of the Enceladus auroral footprint

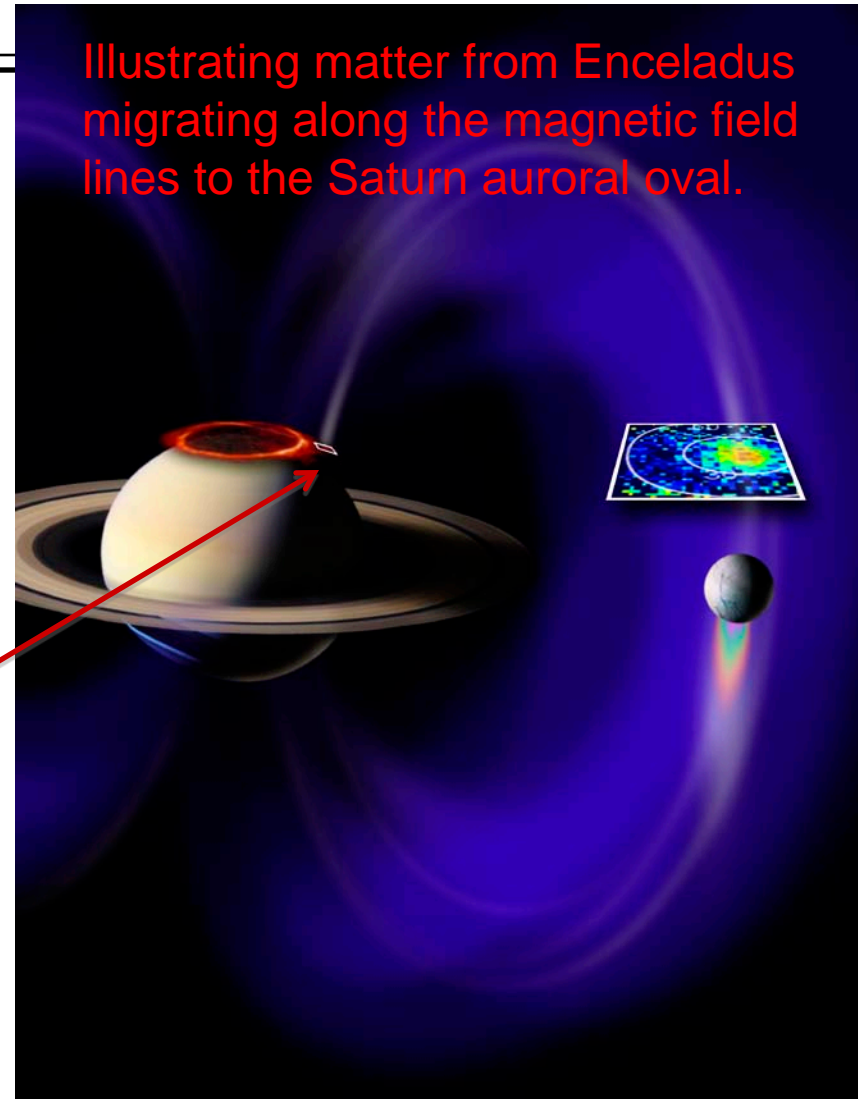
Rymer et al.

“Field aligned” ions and electrons were observed close to Enceladus both times we have measured along the magnetic field.

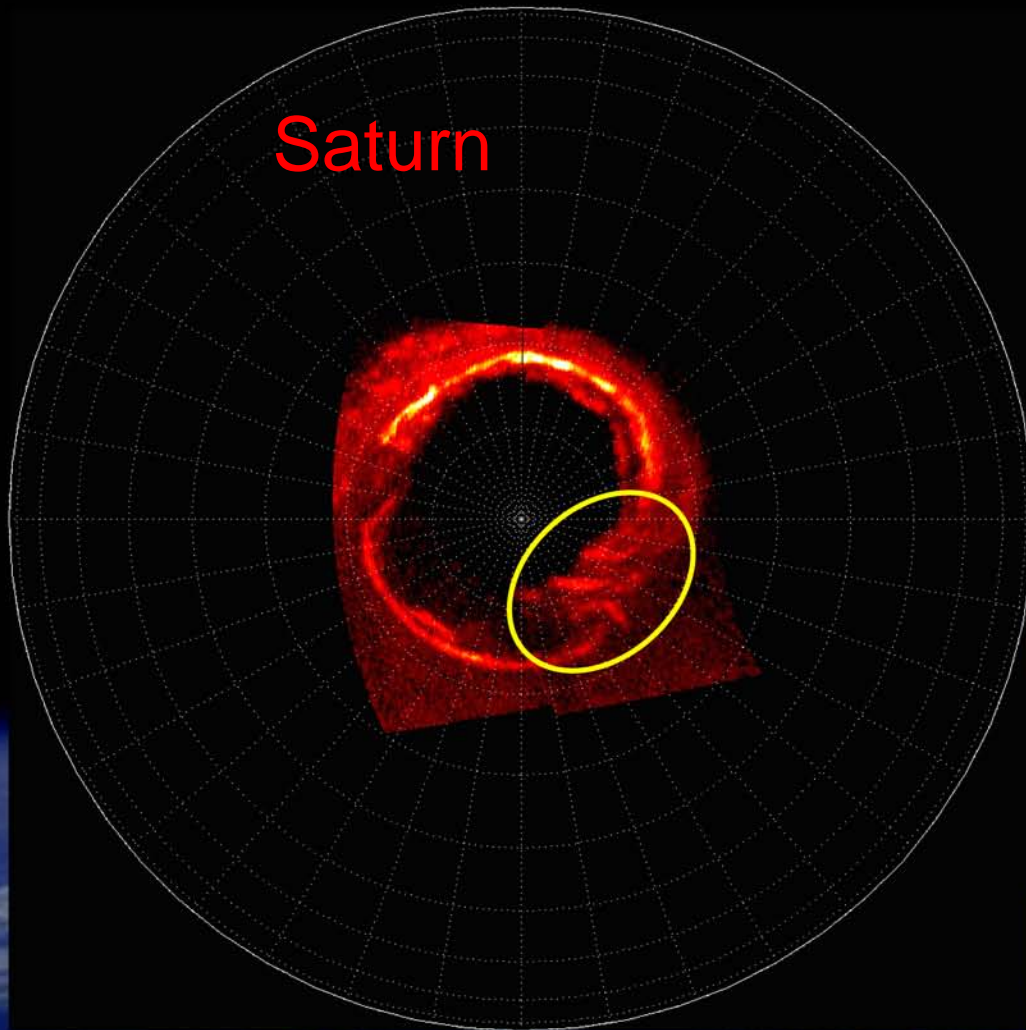
Power associated with FACs corresponds to 3-13 kR UV output.

UVIS observations show that the auroral footprint is occasionally (2%) visible with an emission ~ 2 kR.

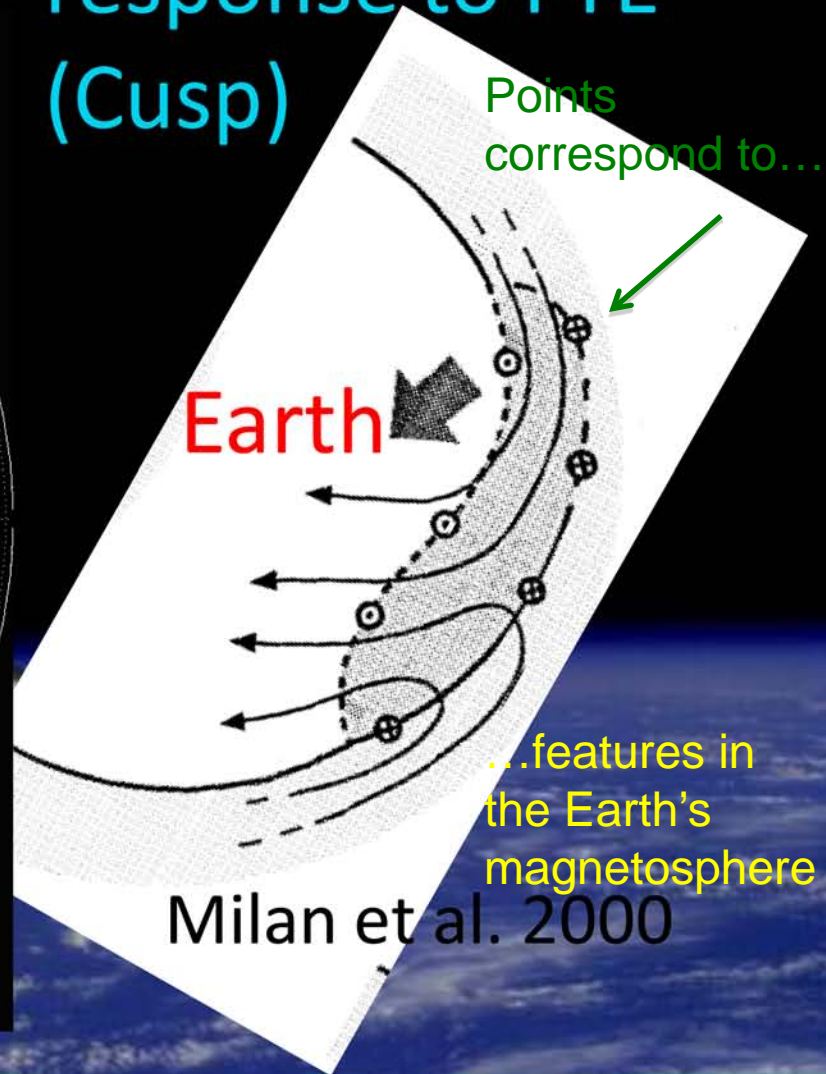
footprint



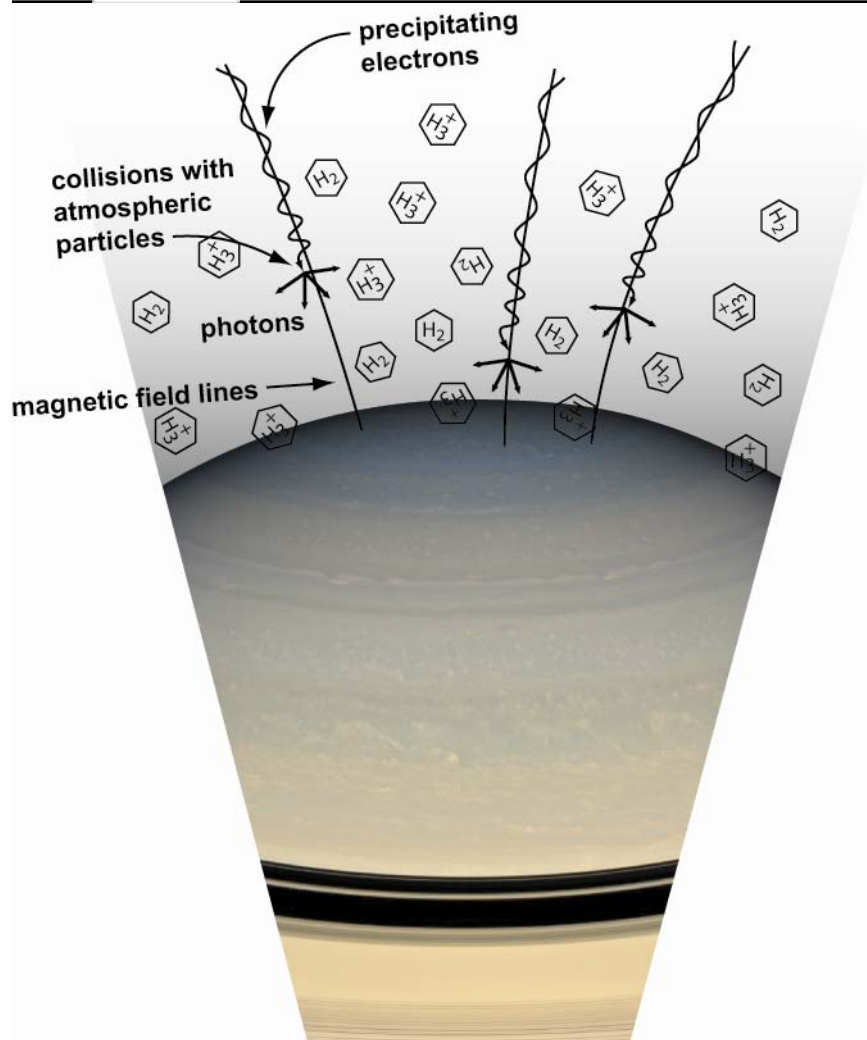
best UVIS (pseudo) image



Ionospheric response to FTE (Cusp)



Saturn Aurora in UV, Visible and IR

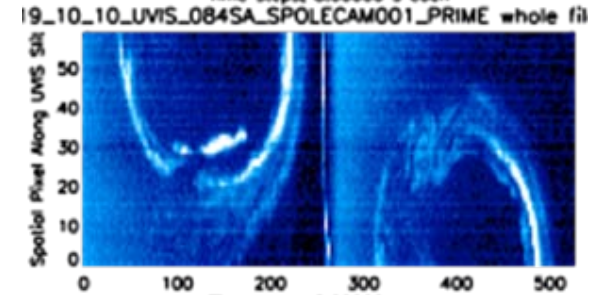
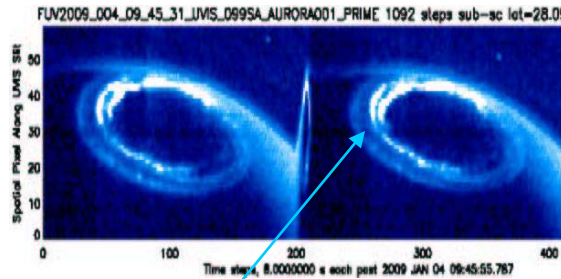
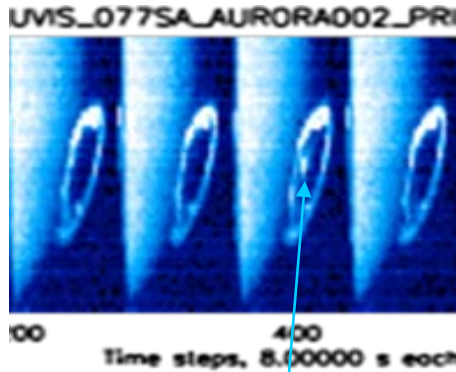
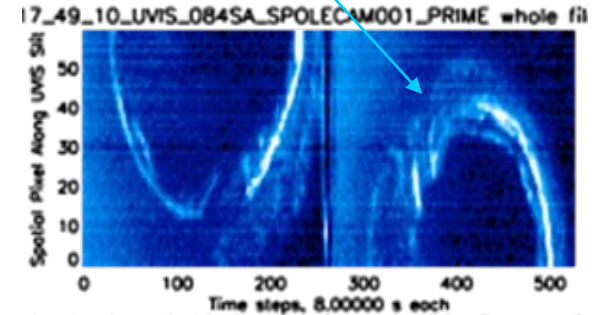
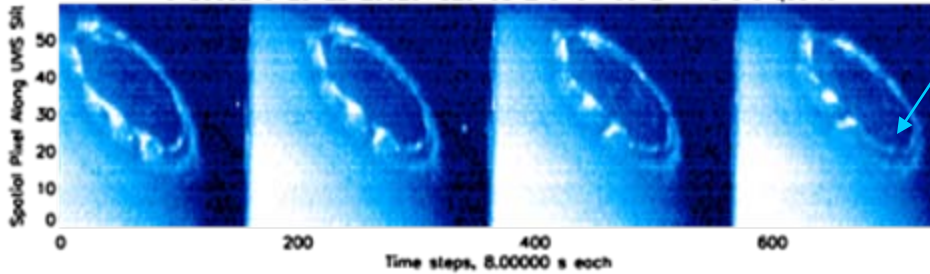


- Auroral emissions indicate the existence of certain molecular/atom and its density.
- The emission intensity and format indicate electron energies and their origin.

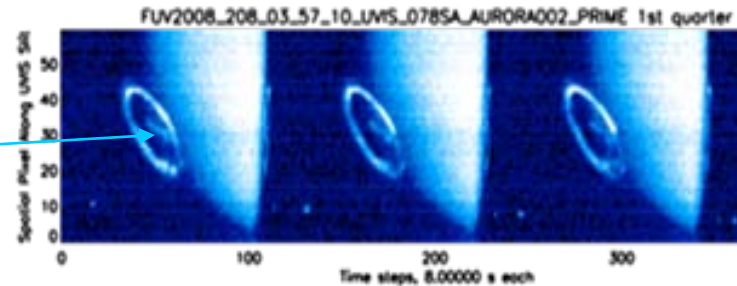
	IR	Visible	UV
Cassini instrument	VIMS	ISS	UVIS
Originator	H_3^+	unknown	H_2
Wavelength (μm)	3.95	0.3-0.9	0.09-0.17
Precipitated electron energy (keV)	unknown	unknown	10-18
Pressure level (μbar)	unknown	unknown	0.1-0.3
Peak intensity (kR)	20-50	~200 R/nm	10-15
References	Stallard, et al., Nature, 2008	Dyudina, et al., DPS, poster, 2008	Gustin, et al., Icarus, 2009

Various Saturn UV Auroral Features

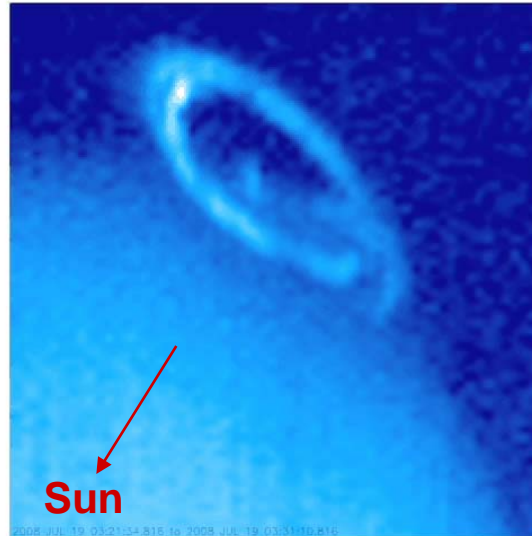
- Spiral oval and fine auroral structure in the **southern** hemisphere.



- Auroral flare, spiral oval and transpolar arc in the **northern** hemisphere.



- Movie for the complex “storm” near N Noon (2008 Day 201)



- Movie for the rotating aurora along the N dawnside oval (2008 Day 129)

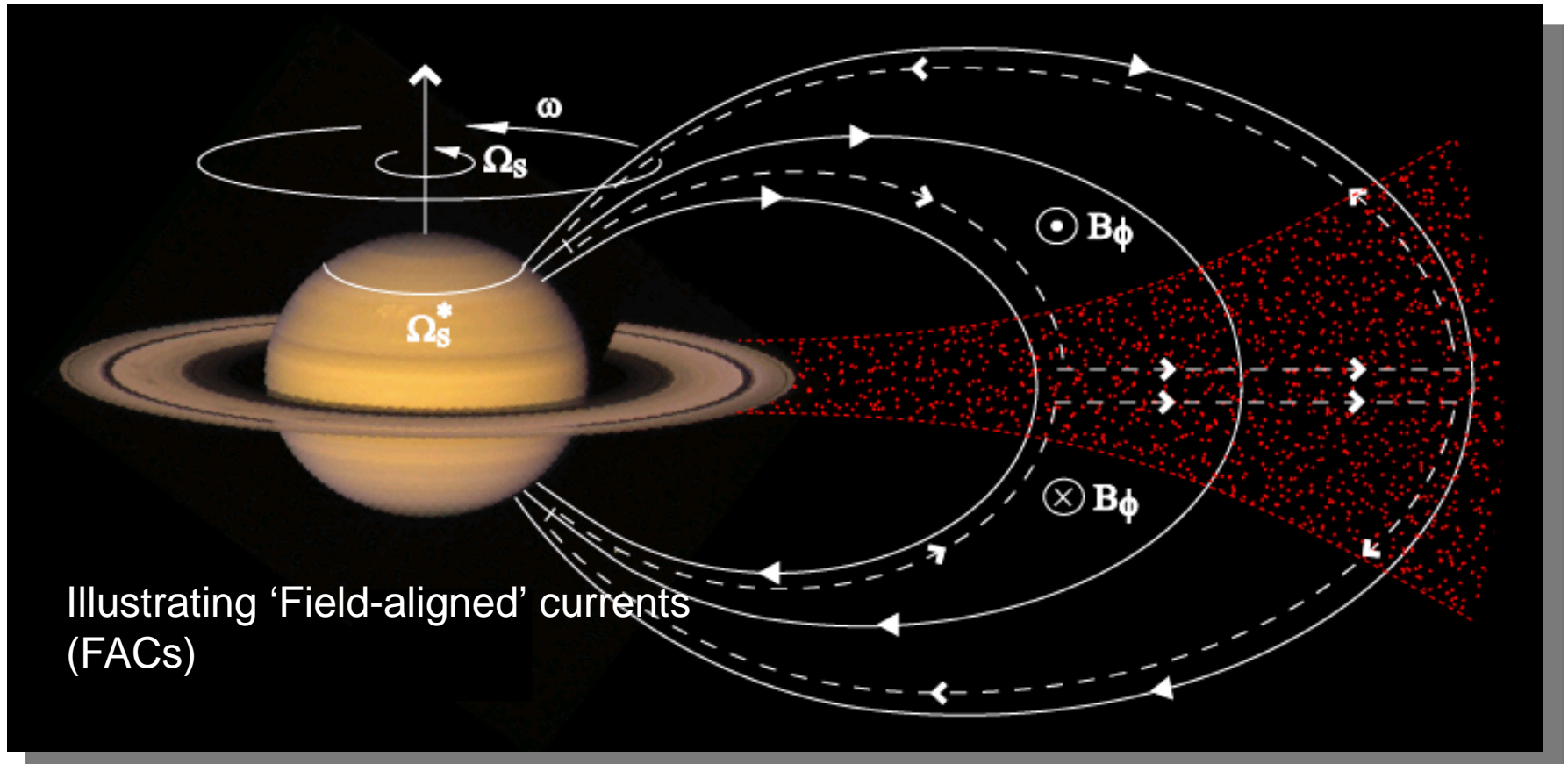
Auroral signatures in ultraviolet wavelengths (0.09-0.17 μm)

- Spiral oval in both hemispheres
- Dayside auroral flares, storms
- Emitted by excited H_2
- Transpolar arc in north polar cap
- Corotating auroral intensification accompanied by “partial ring current” (seen by MIMI/INCA)

Sun



Magnetosphere-Ionosphere coupling currents

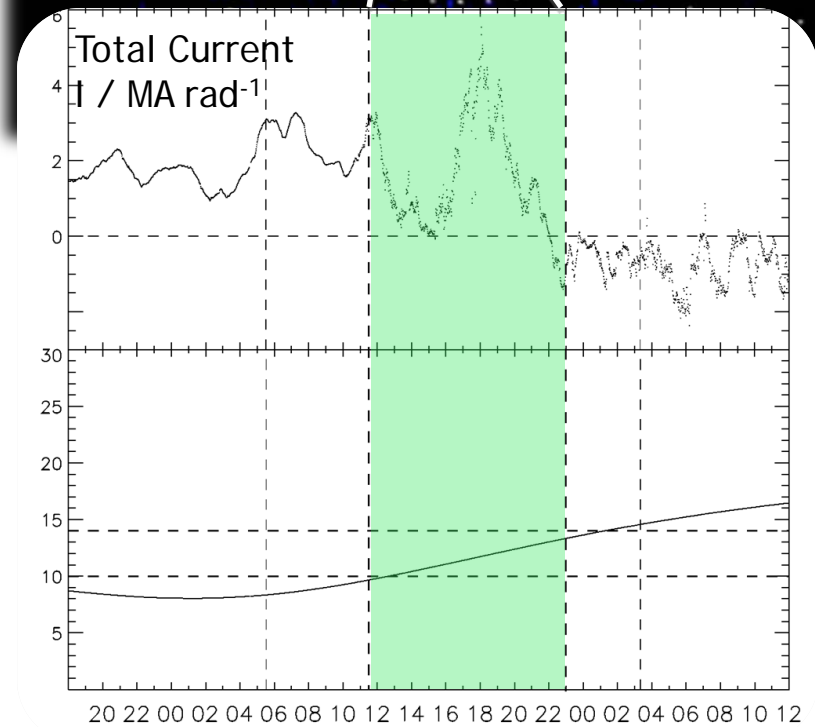
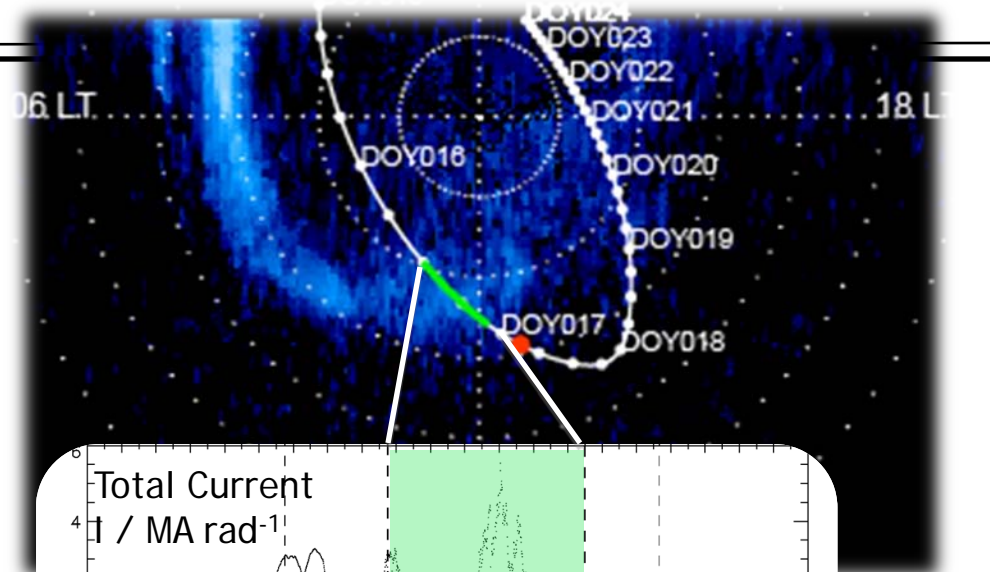


Illustrating 'Field-aligned' currents (FACs)

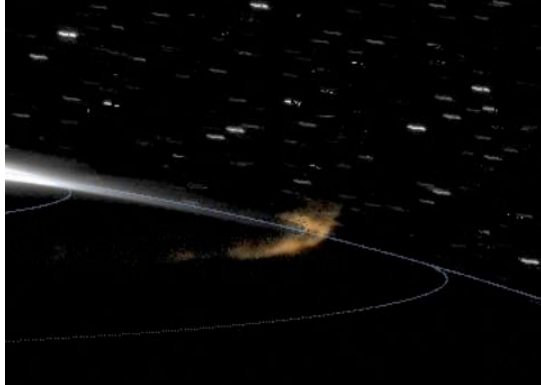
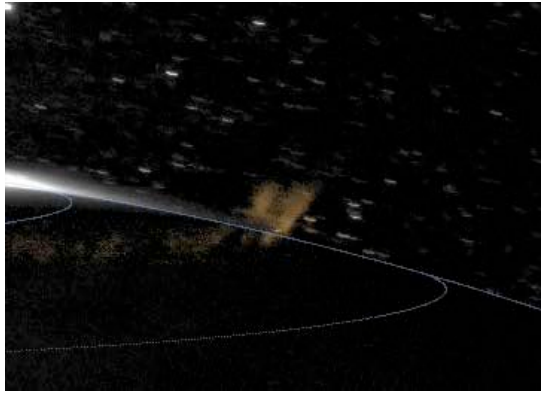
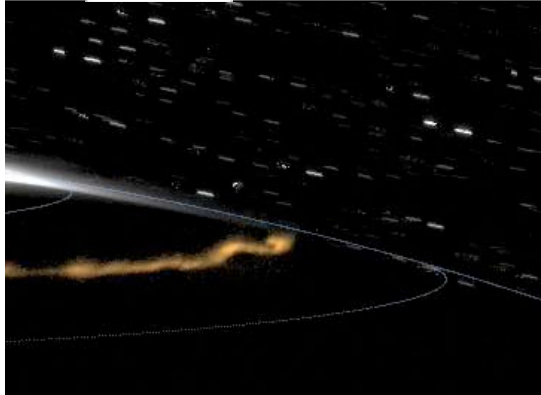
Bunce et al., 2003

Work in Progress

- Signatures of field-aligned currents flowing between the magnetosphere and ionosphere identified by Cassini magnetometer
- Boundary between open and closed field lines identified, where upward-directed field-aligned current flows, with density requiring downward acceleration of electrons sufficient to produce aurora (Bunce et al., 2008)
- Mapped location and strength of field aligned current signatures are being compared with CAPS electron fluxes

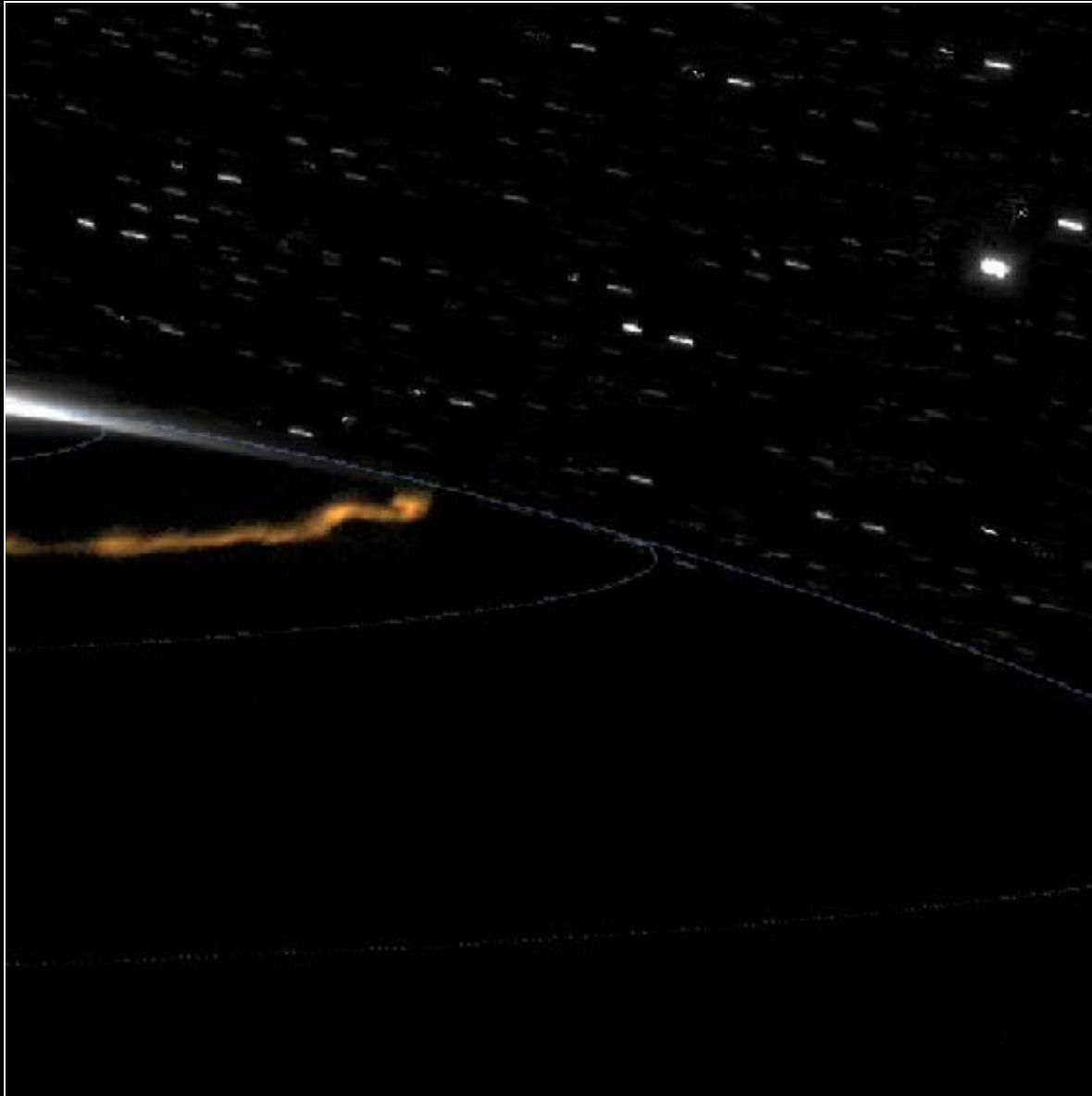


First significant visible-light photos of Saturn's faint northern lights (aurora) from ISS



- Flickers and changes on timescales of minutes
- First view of their 3-D curtain-like appearance
- Curtains rise 1200 km (750 miles) above Saturn at $\sim 70^\circ$ lat
- Patterns rotate with Saturn
- Nearly 500 photos obtained from Oct. 5 to 8, 2009
- Will help scientists to understand how auroras are generated at Saturn and to estimate energy of electrons hitting the atmosphere causing it to glow
- Colorized orange here; scientists are working to understand the true color of Saturn's northern lights

Cassini ISS Provides Detailed Images of Saturn's Aurora

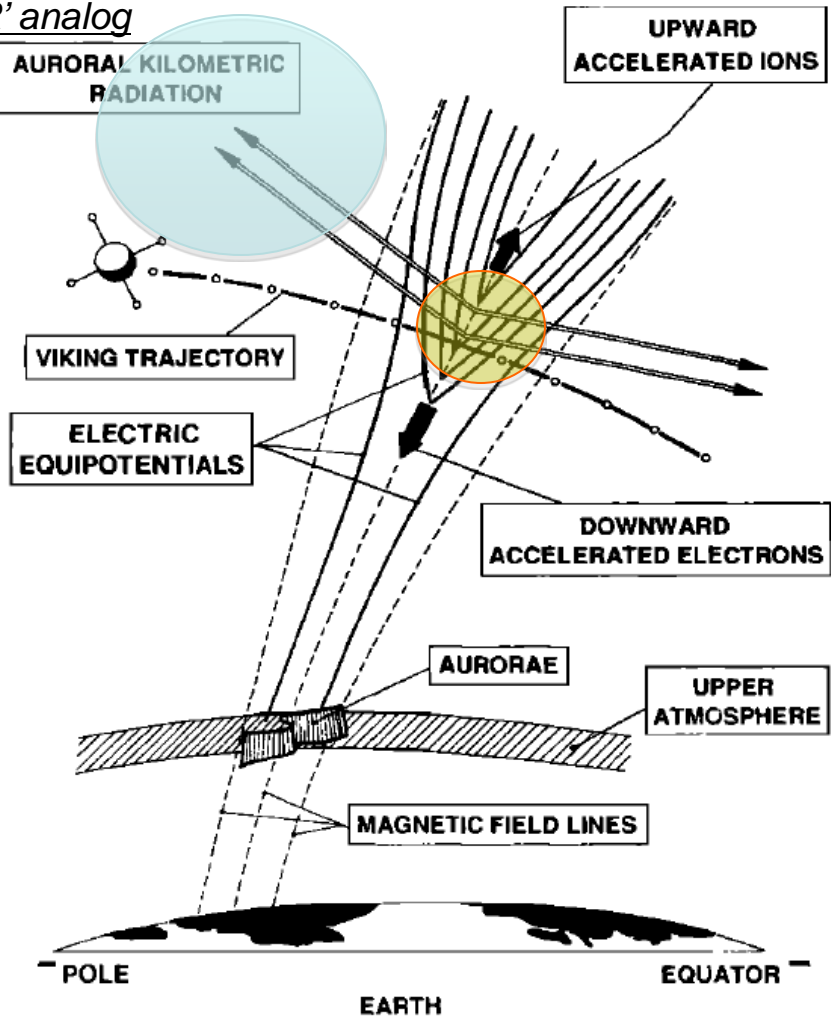


Earth – Saturn Comparison

Auroral Kilometric Radiation (AKR) is the Saturn 'SKR' analog

Viking made in situ measurements of the electron distribution in an AKR source region.

This is a simplified schematic of the relationship of Viking's trajectory through an auroral acceleration region and associated AKR source.

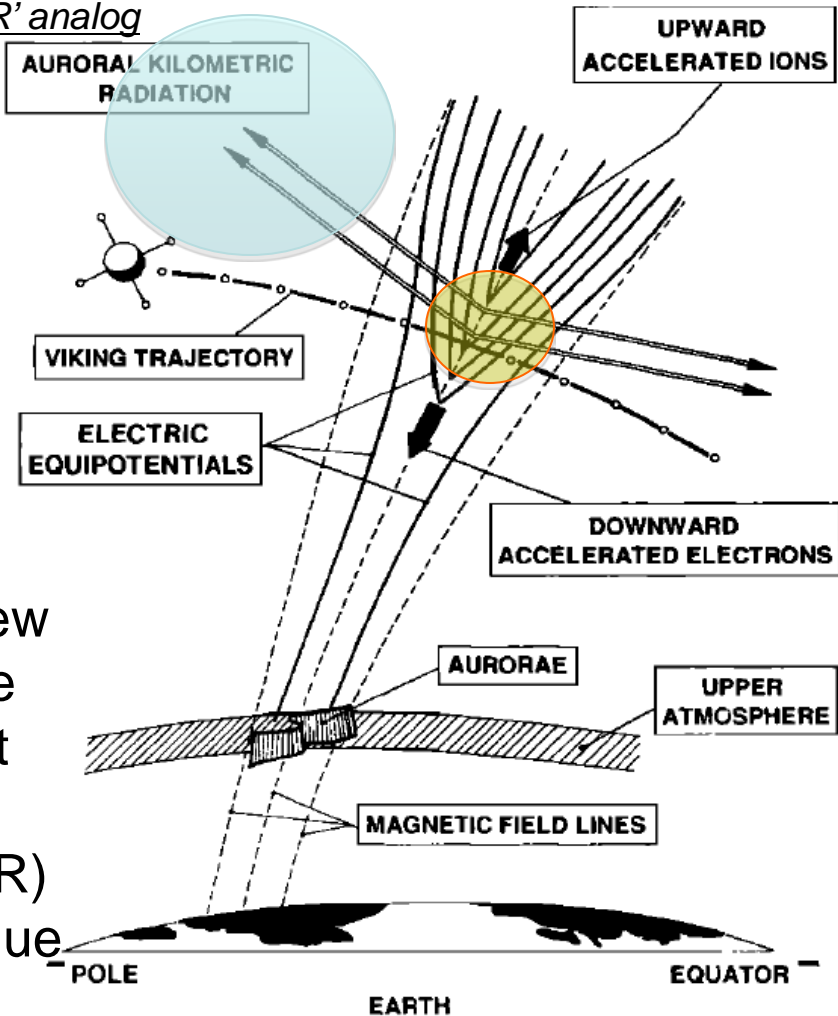


Earth – Saturn Comparison

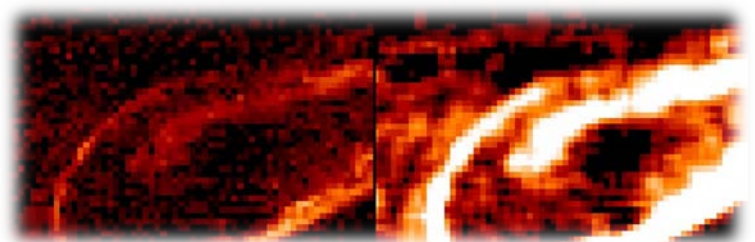
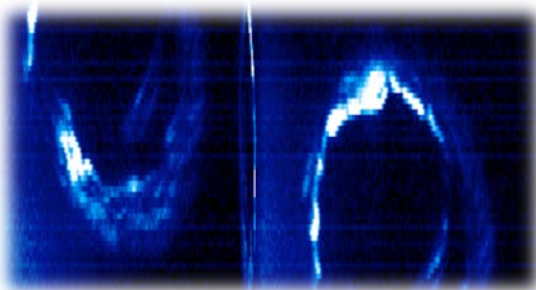
Auroral Kilometric Radiation (AKR) is the Saturn 'SKR' analog

In an analog with Viking – Oct. 17, 2008, Cassini seems to have flown through a region of 'hiss' followed by downward moving electrons followed by a region of upward field-aligned current.

The most important aspect of this event, which suggest that Cassini flew through the source region, is that the low-frequency cutoff of the SKR is at and below the electron cyclotron frequency (f_{ce}). Since SKR (and AKR) are generated at f_{ce} , this is a good clue that we're in or very close to the source.



- How does the main auroral oval at different local times relate to the field-aligned currents?
- How does the sub-structure in the upward FAC relate to the fine structure in the aurora?
- What is the relationship between the field-aligned currents and the magnetic field oscillations?
- How does the ring current relate to the field-aligned currents?
- What are the physical conditions under which the two main types of field-aligned current occur? What dynamical event is occurring to produce the super-corotating flows (with associated 'leading' field signatures)?



Thanks for listening!

