Hemispheric Asymmetries in the Dayside Aurora

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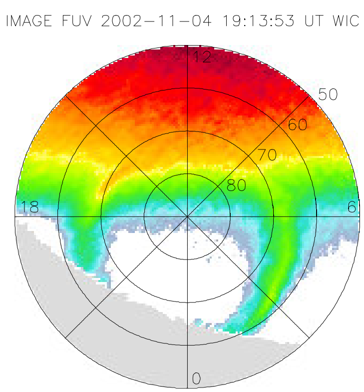
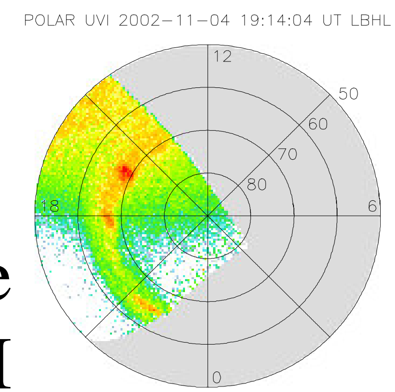


Northern Hemisphere
IMAGE WIC



Southern Hemisphere
Polar UVI

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Introduction

- Focus on afternoon sector – 15 MLT bright spot
- Region of persistent auroral emission centered near 15 MLT and 75 degrees latitude [*Cogger et al.*, 1977; *Liou et al.*, 1997]
- Caused by low energy (< ~ 1 keV) electron precipitation [*McDiarmid et al.*; 1975, *Evans*, 1985; *Newell et al.*, 1996]
- Co-located with maximum in Region 1 upward field aligned current [*Iijima and Potemra*, 1987]
- Appearance and behavior influenced by solar wind and IMF [*Murphree et al.*, 1981; *Vo and Murphree*, 1995]
- Can be structured and dynamic (string of pearls configuration) [*Lui et al.*, 1987; *Potemra et al.*, 1990, *Rostoker et al.*, 1992]
- Varies with season: more likely in summer [*Liou et al.*, 2001] **=>** hemispheric differences

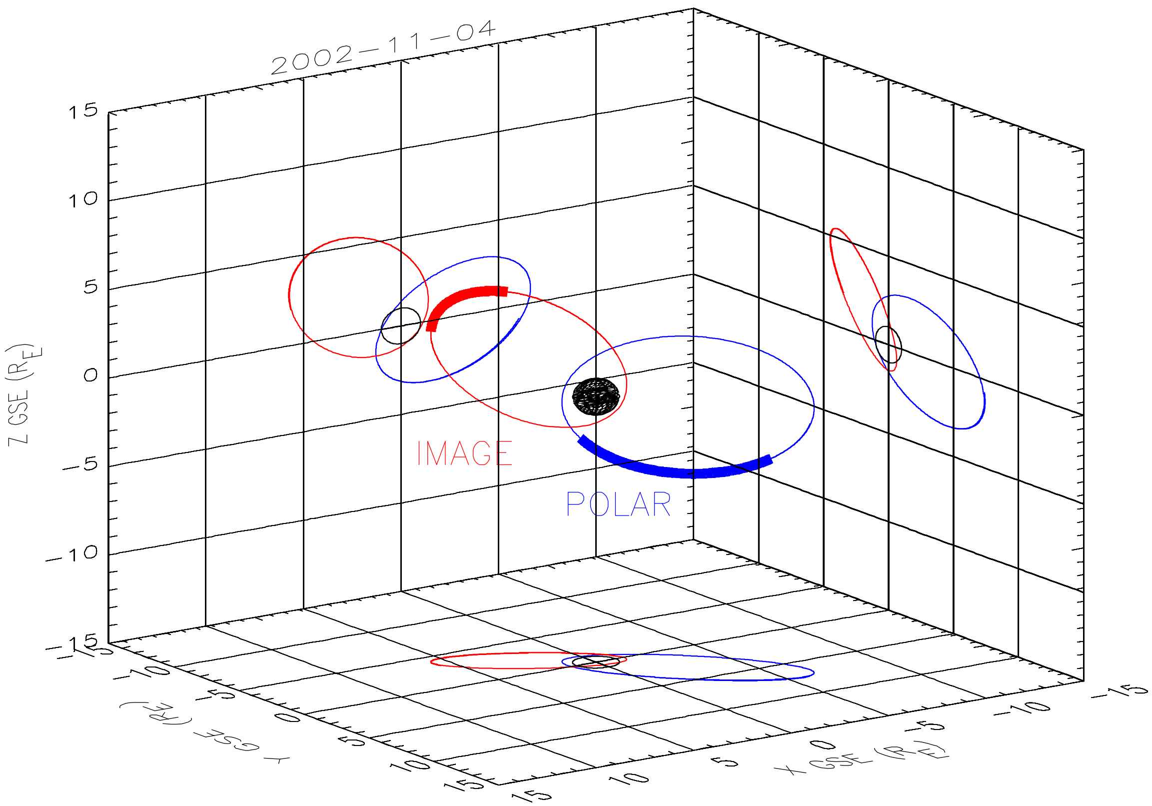
Introduction (cont'd)

- Previous conjugate observations limited to small scales (in situ point measurements or ground based instruments) in at least one hemisphere [*Dickinson et al.*, 1986; *Mende et al.*, 1990; *Burns et al.*, 1990, 1992; *Vo et al.*, 1995]

- Present first simultaneous images of dayside aurora from two global auroral imagers in opposite hemispheres (IMAGE WIC in northern hemisphere and Polar UVI in south)
- Address issue of conjugacy of dayside aurora on a synoptic scale for the first time
- Relate differences in aurora to solar wind and IMF input

Spacecraft Orbits

From October 2002 to March 2003 IMAGE WIC and Polar UVI were in ideal positions and orientations for dayside conjugate observations



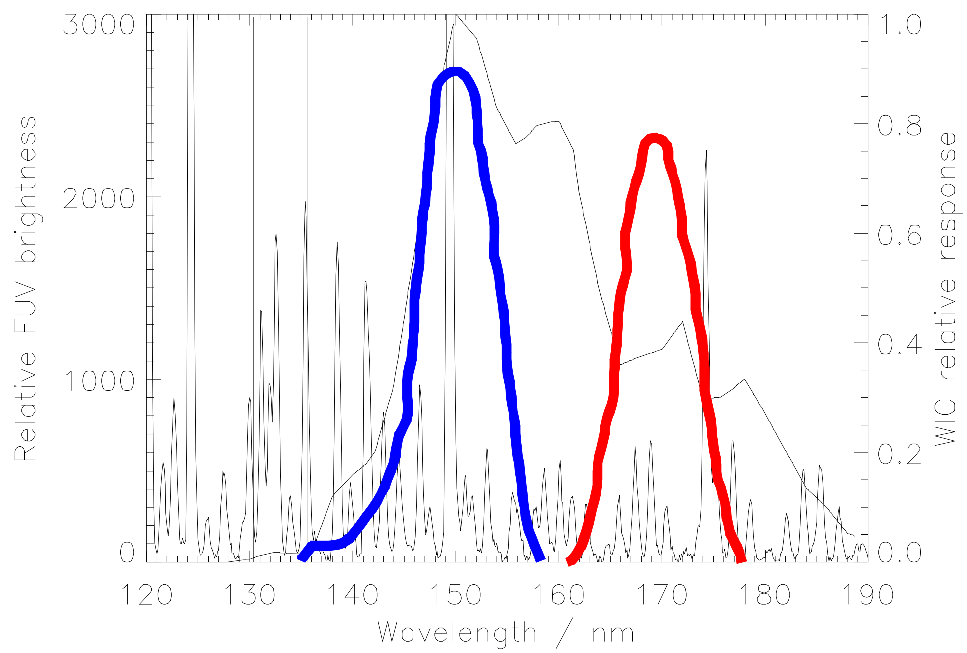
Instrumentation

IMAGE Wideband Imaging Camera (WIC) &
Polar Ultraviolet Imager (UVI) LBHS & LBHL

Temporal resolution
WIC: 10 second integration every 2 minutes
UVI: 18 & 36 second integration, cyclic

Spatial resolution
WIC: ~ 50 km
UVI: ~ 30 km

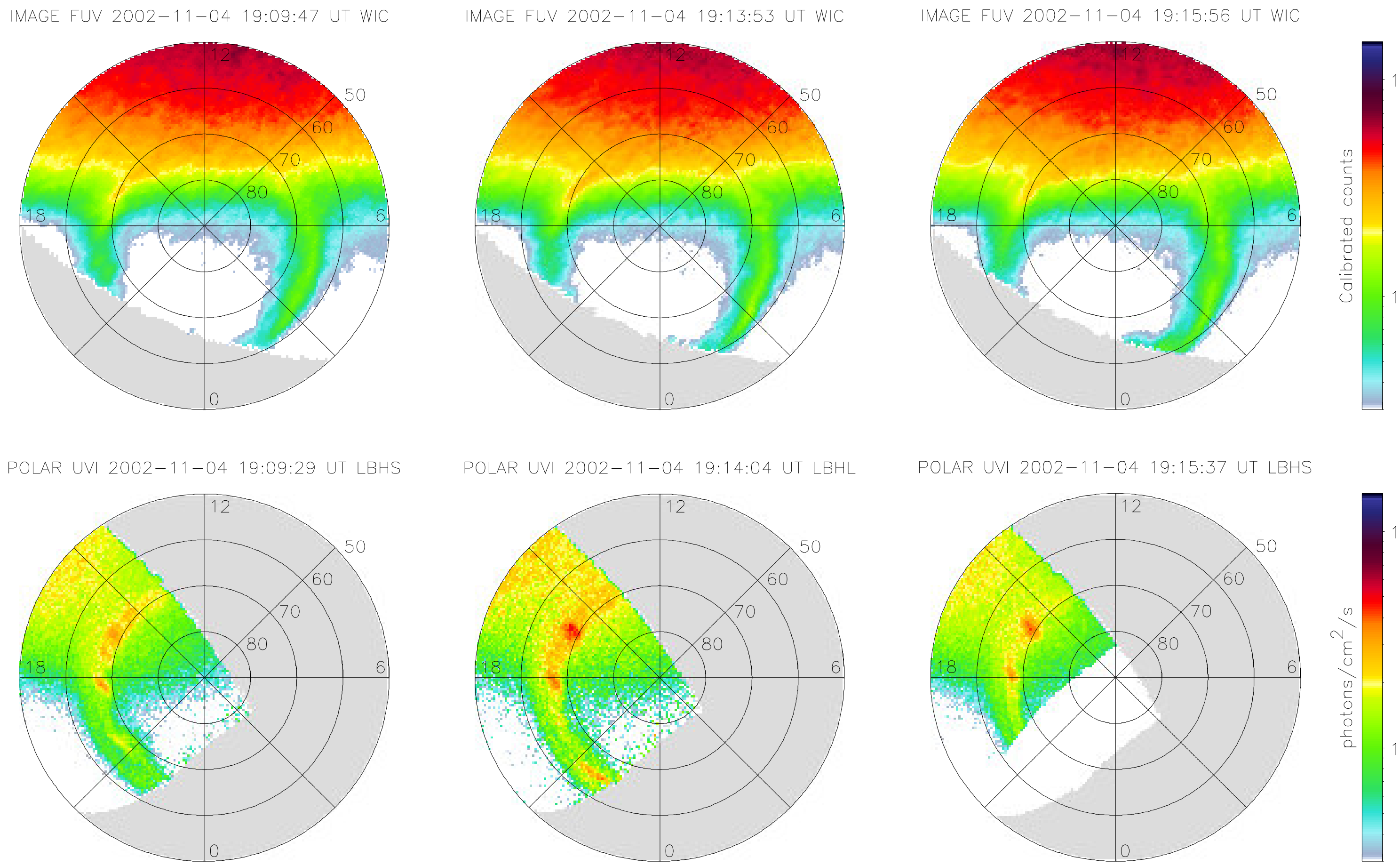
Spectral resolution
WIC: 140 to 190 nm –
LBHS: 140 to 160 nm –
LBHL: 160 to 180 nm –



4 November 2002

Northern Hemisphere

Southern Hemisphere



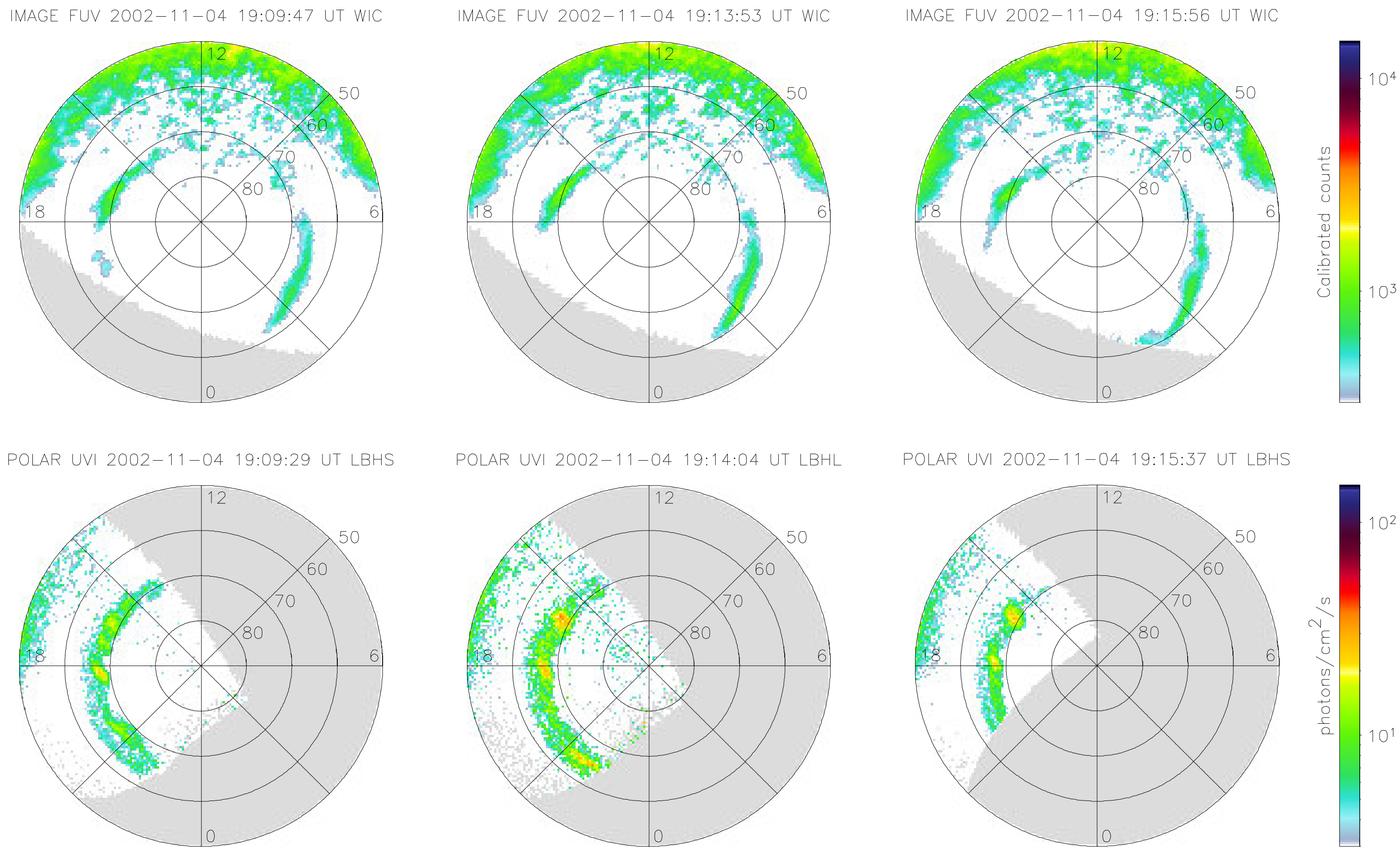
NH: enhanced, unstructured emission in afternoon

SH: multiple spots; number, location, and intensity change

4 November 2002

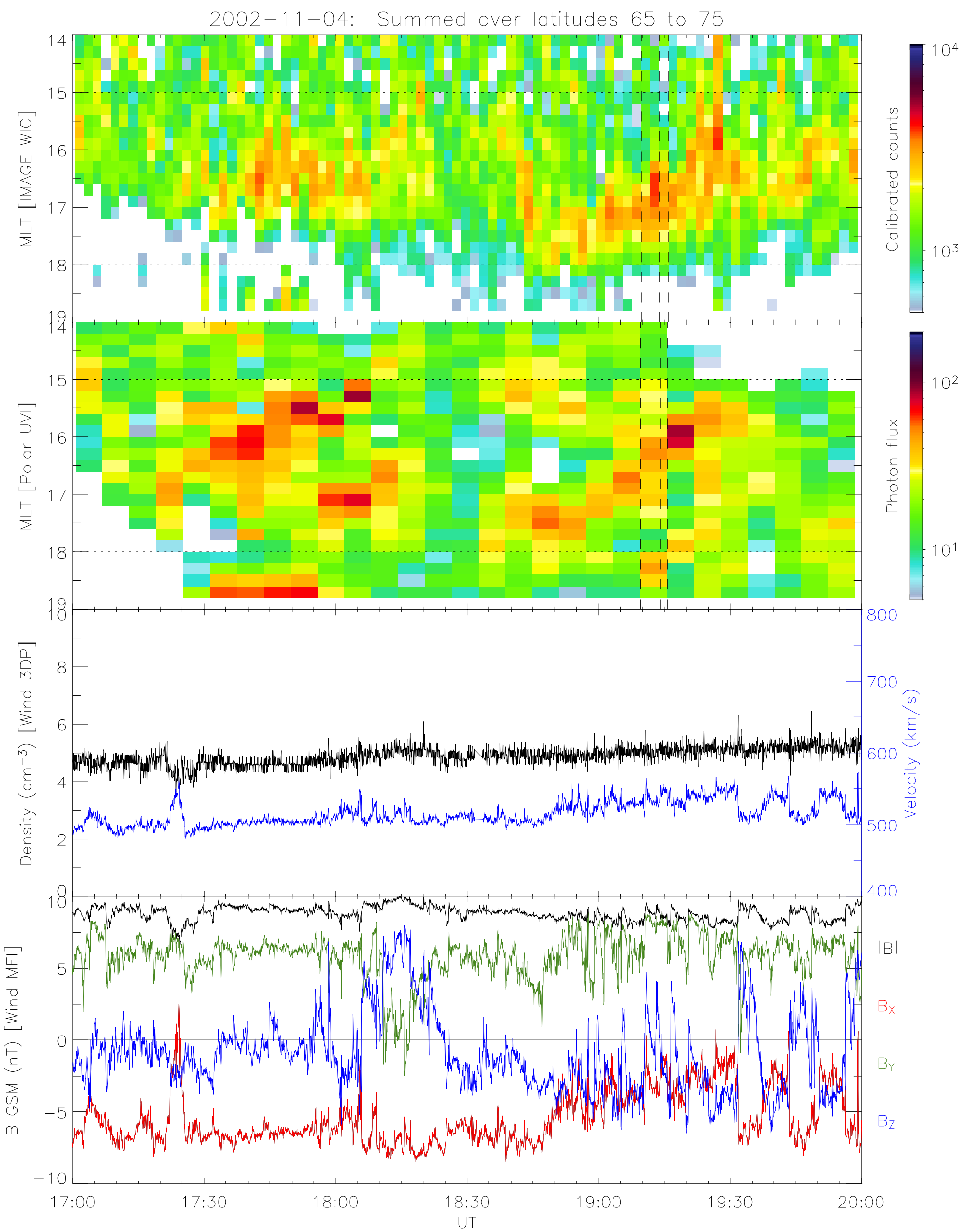
Northern Hemisphere

Southern Hemisphere



NH: enhanced, unstructured emission in afternoon

SH: multiple spots; number, location, and intensity change



NH: enhanced emission in afternoon; variable intensity and location; single region

SH: multiple regions of emission; vary in intensity and location; different regions behave differently

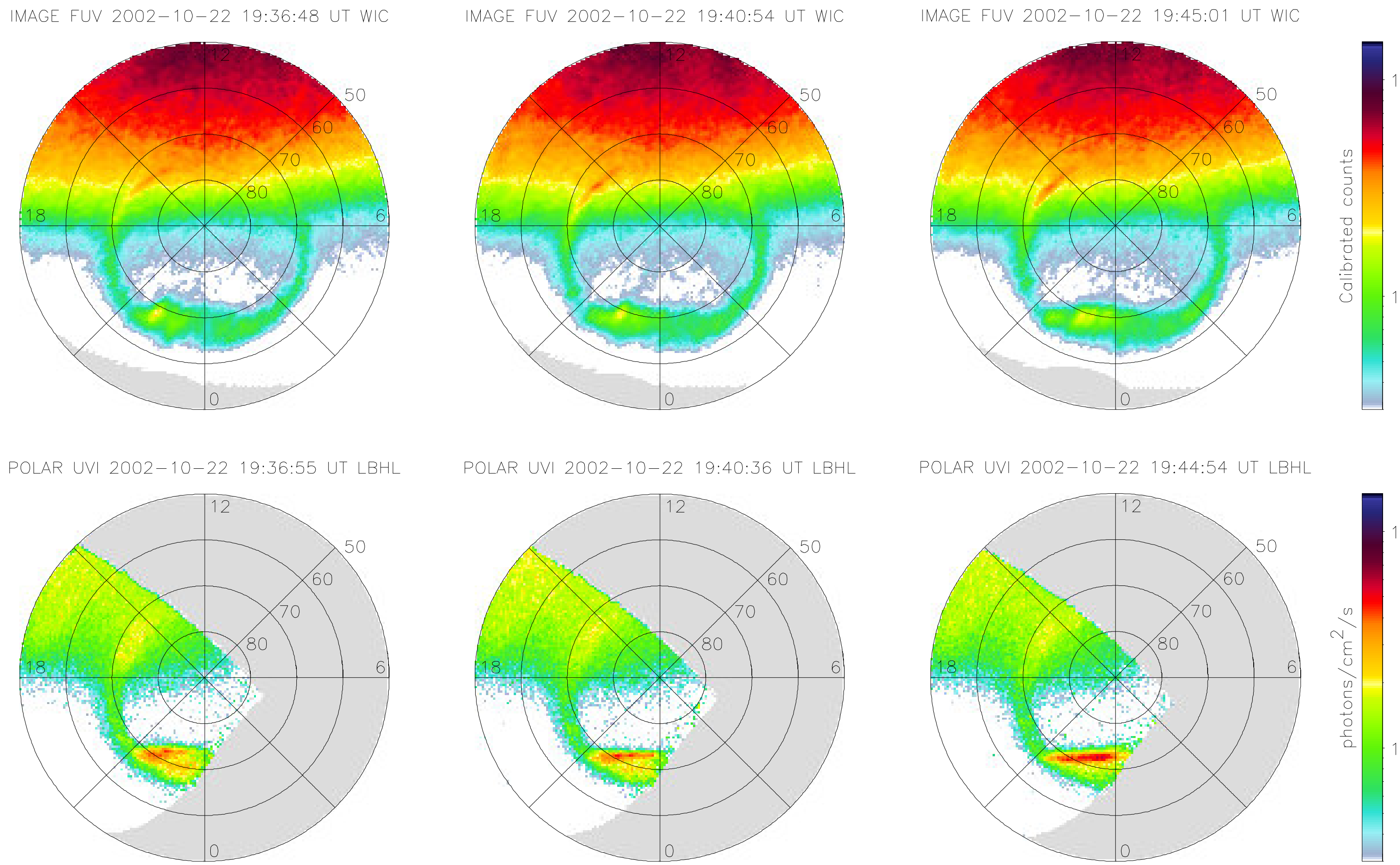
Steady solar wind density and velocity

IMF $B_X < 0$
$B_Y > 0$
$B_Z < 0$ (with some positive excursions)

22 October 2002

Northern Hemisphere

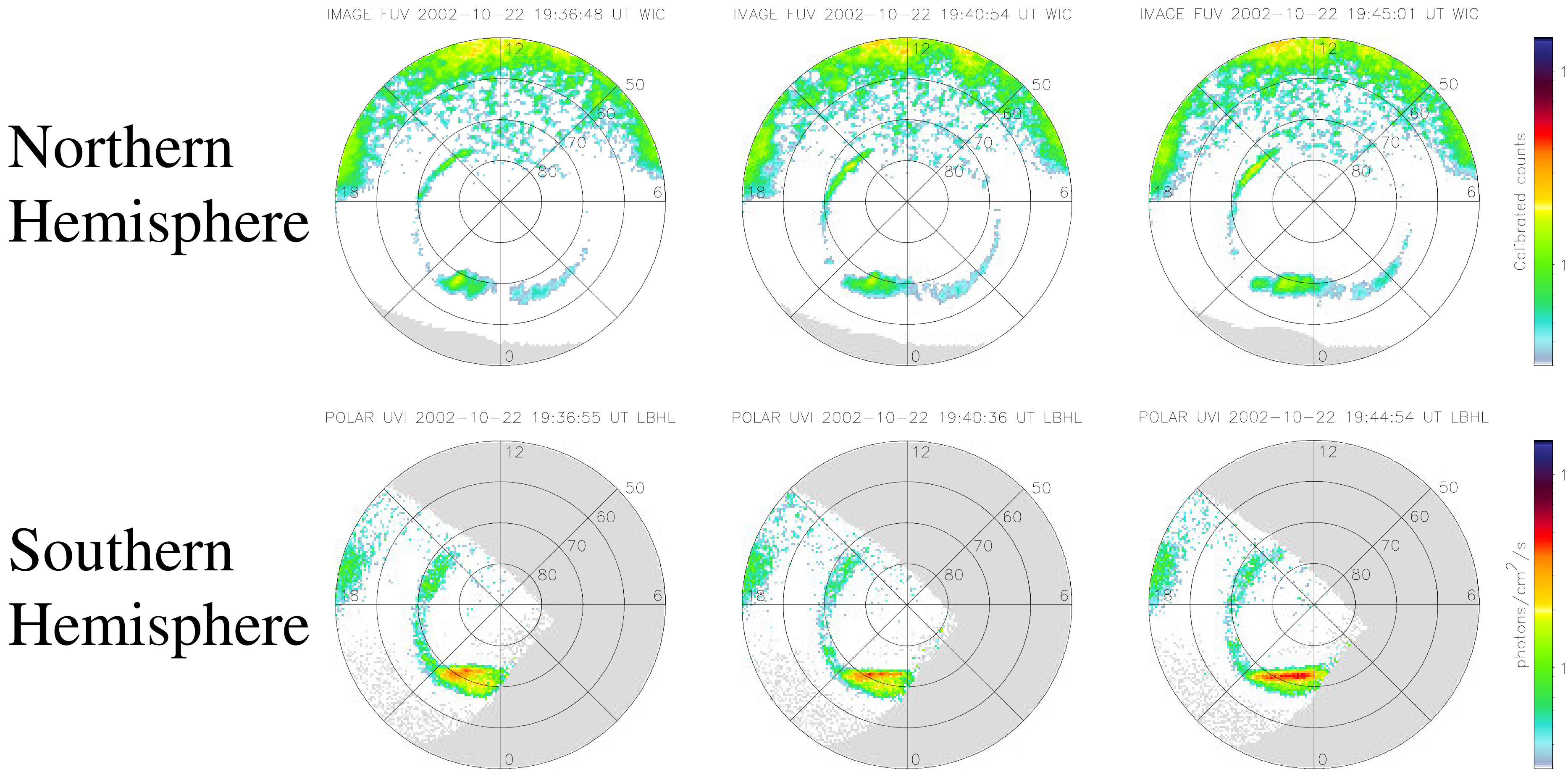
Southern Hemisphere



NH: latitudinally narrow emission, brightens near 19:40 UT

SH: broader, more diffuse emission; no noticeable change

22 October 2002



NH: latitudinally narrow emission, brightens near 19:40 UT

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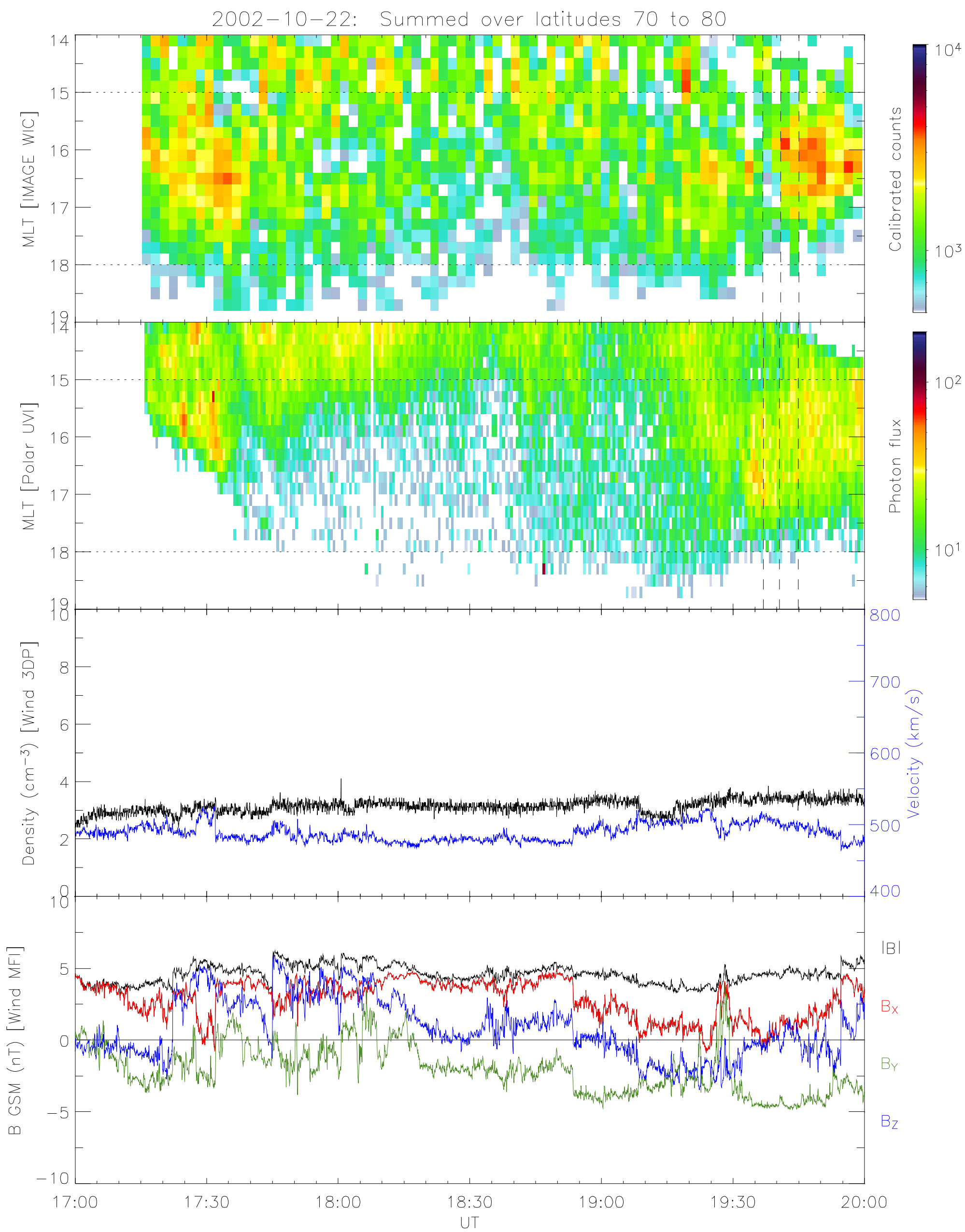


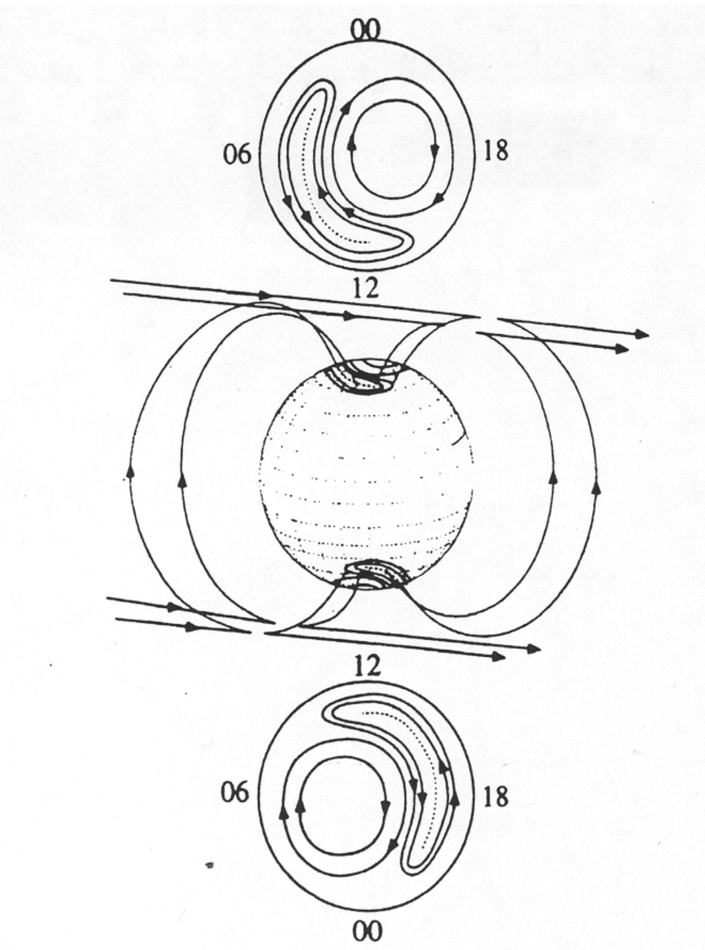
NH: very quiet from 17:45 to 19:15 UT; brightening near 19:40 UT; narrow MLT range (peaked)

SH: aurora brightens near 19:30 UT; diffuse in latitude and MLT

Steady solar wind density and velocity

IMF $B_X > 0$
$B_Y < 0$
$B_Z < 0, > 0, <0$

Interpretation



For $B_Z < 0$, strong B_Y

=> mirror image convection patterns

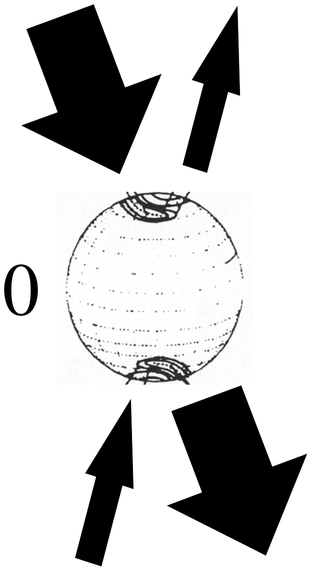
Strong flow shear, divergent $E_\perp$, $J_\perp$, strong $J_{//}$

=> more discrete auroral structure (brighter?)

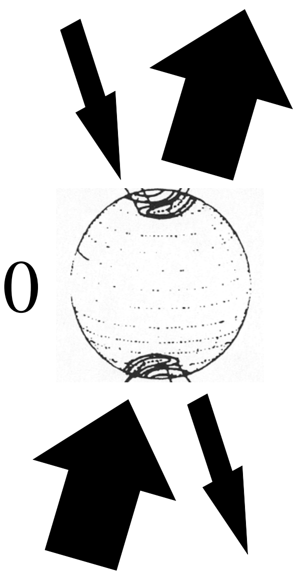
=> Hemispheric asymmetry

(from *Clauer et al.*)

$B_Y > 0$



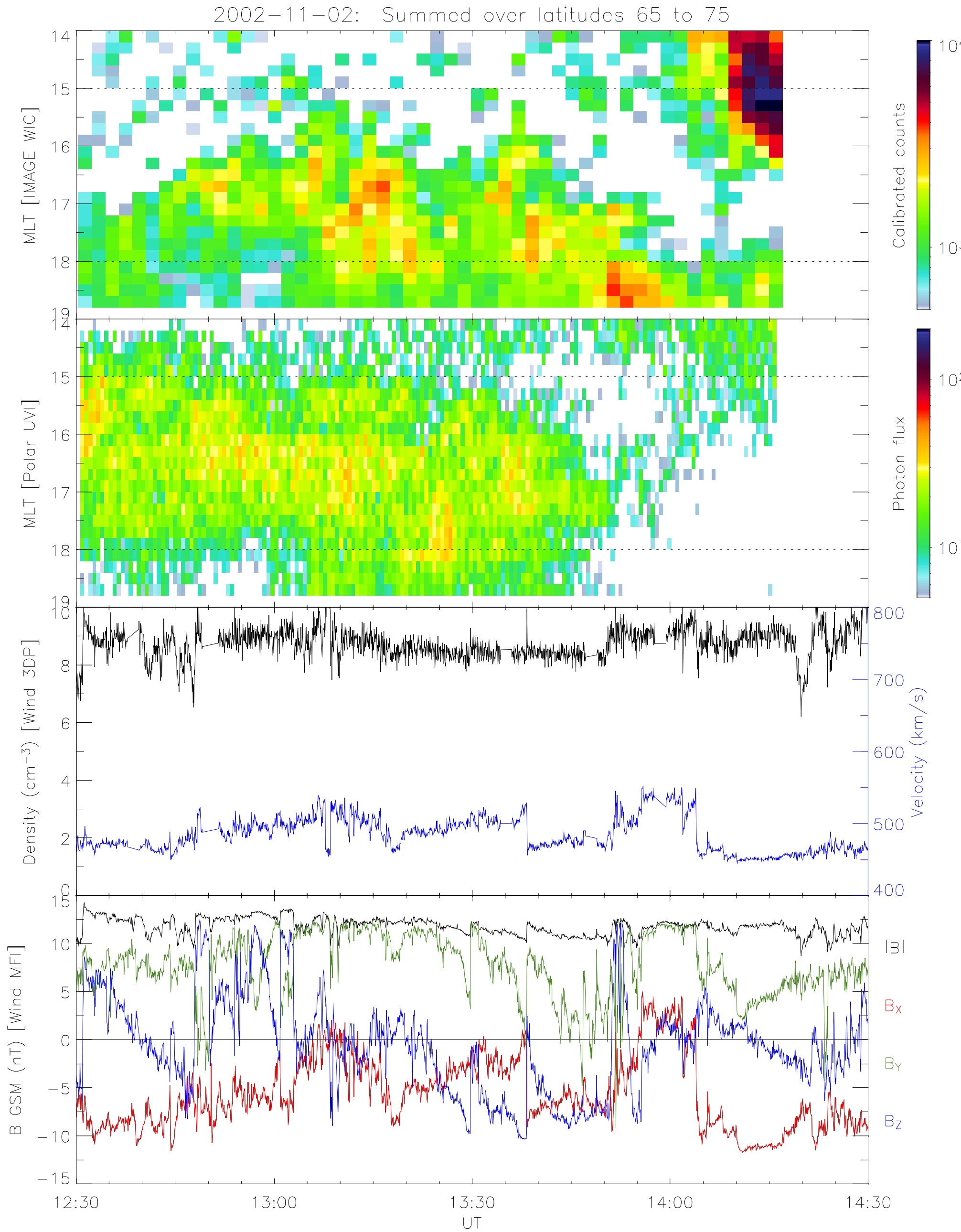
$B_Y < 0$



Summary

- Present first simultaneous synoptic scale observations of dayside aurora in opposite hemispheres
- Hemispheric asymmetries in afternoon aurora controlled by IMF orientation
- For $B_Z < 0$ ...
- $B_Y > 0$, structure in afternoon aurora in southern hemisphere
- $B_Y < 0$, structure in northern hemisphere
- Interpreted as due to strong flow shear **=>** strong $J_{//}$

- Source of structure? KHI at low altitude, $|B_Y/B_Z|$, $E_{//}$, ...
- Relate to other ionospheric measurements (convection, $J_{//}$)
- Effects during $B_Z > 0$? (Very quiet on 22 October 2002)
- Effects of variable solar wind density and velocity?



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