

Observations of transition region and chromosphere

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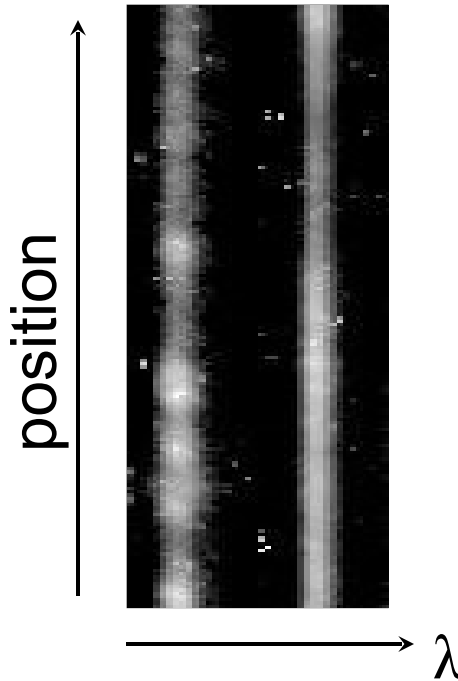
Outline

- Why are the transition region and the chromosphere important?
- Hinode observations
 - explosive events in the transition region
 - photospheric magnetic fields.
- Desired features for the future mission
 - high throughput UV/EUV spectrometer
 - magnetic fields in the chromosphere
 - high sensitivity magnetogram

Behavior of spectra

Transition region
He II (T=4.7)

Line broadenings
and Doppler shift
Up to 100 km/s



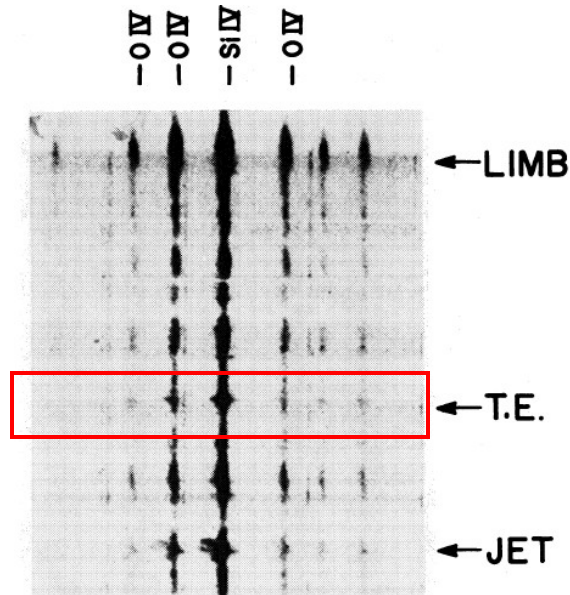
Corona
Fe XII (T=6.1)

Smooth structure

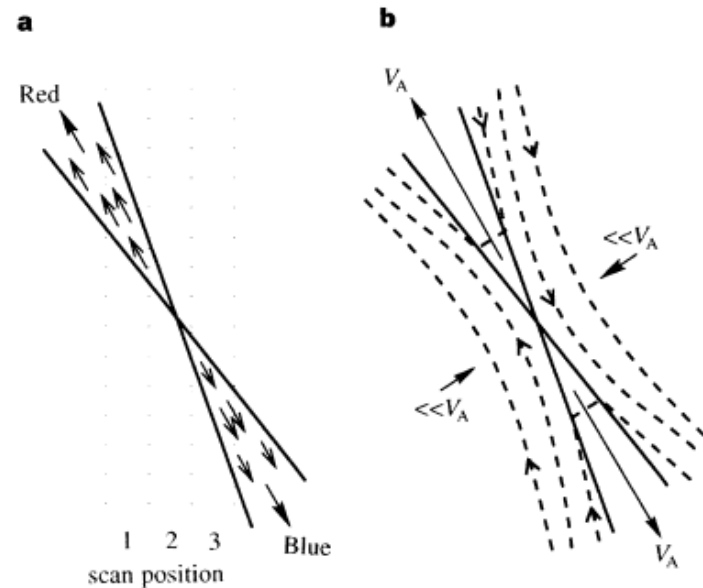
- The transition region and the chromosphere are highly structured and dynamic.
- Something changes between the transition region and the corona

Explosive events

- Explosive events are UV-spectrum broadening events frequently occur in transition region.
- Bi-directional flows caused by reconnection.
- But their relation to magnetic fields in the photosphere have not established yet.

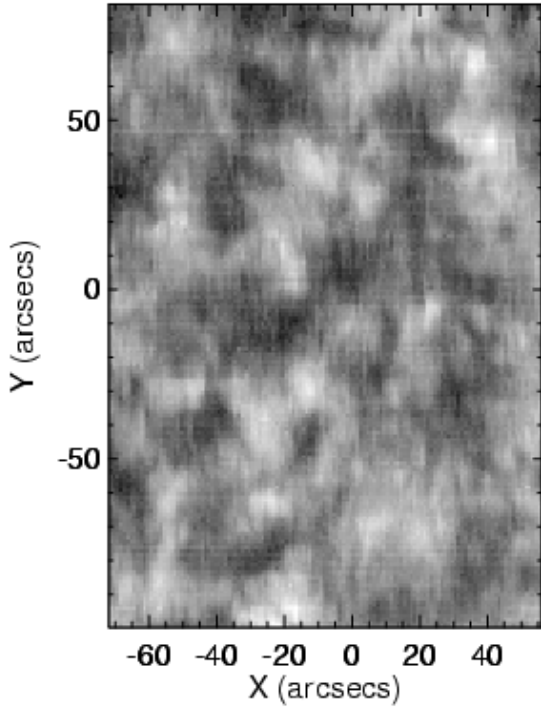


Brueckner & Bartoe (1983)

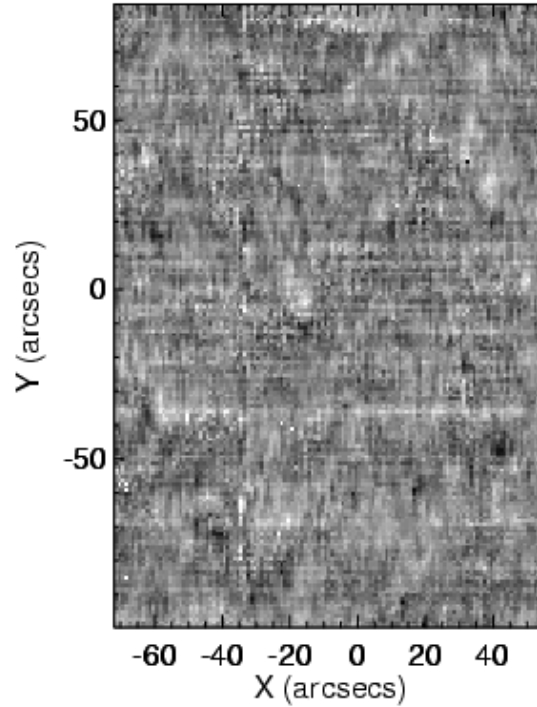


Innes et al. (1997)

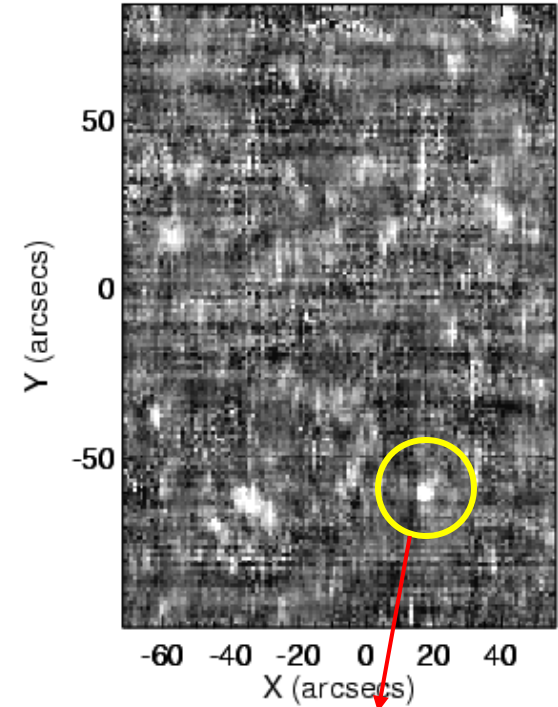
Radiance



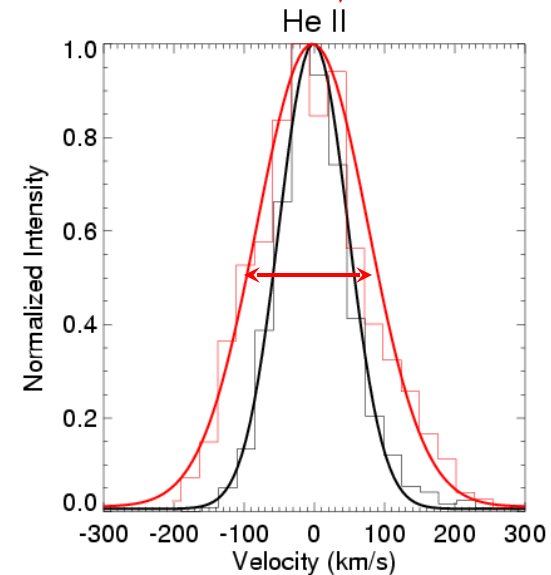
Doppler shift

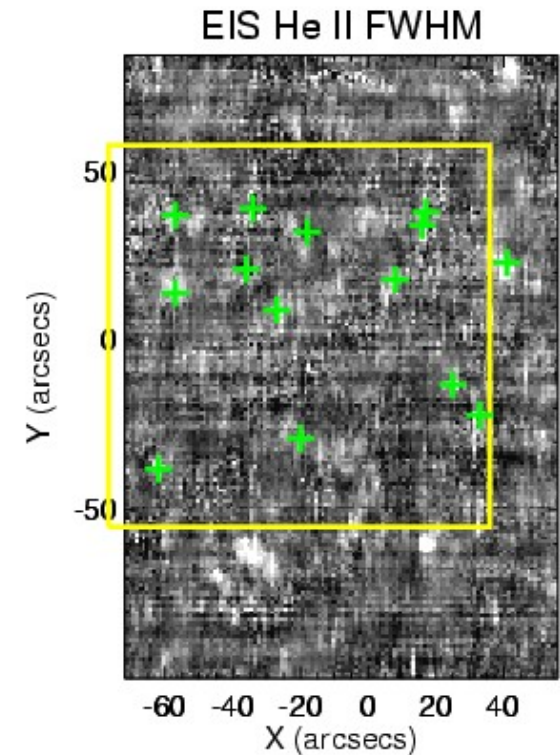
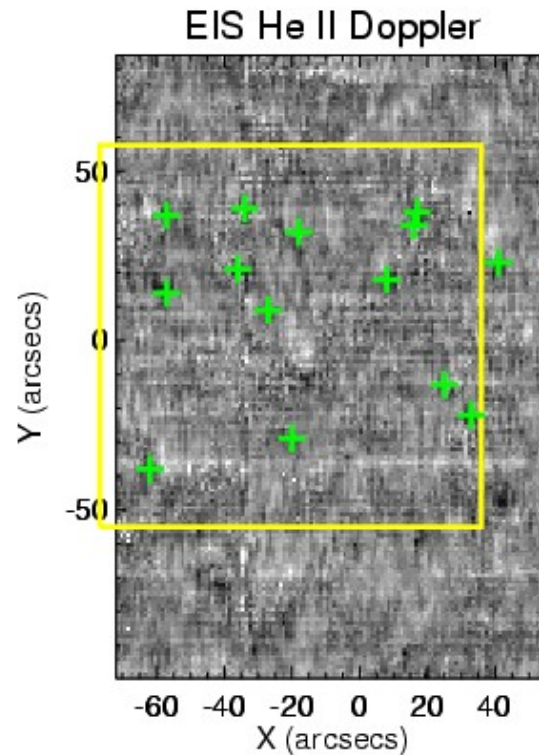
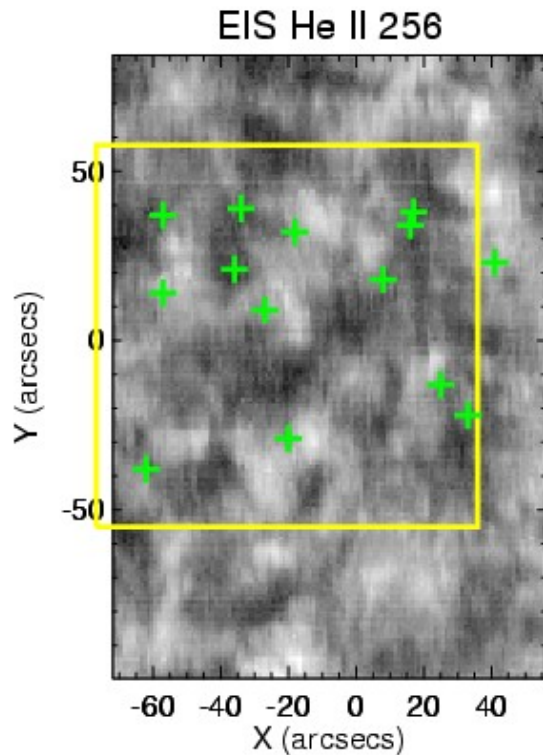


Line width



- Radiance, Doppler shift, and width were derived from He II spectra.
- Spectral width in He II explosive event: **174 km/s**
normal: 93 km/s
(EIS instrumental width: 67 km/s)

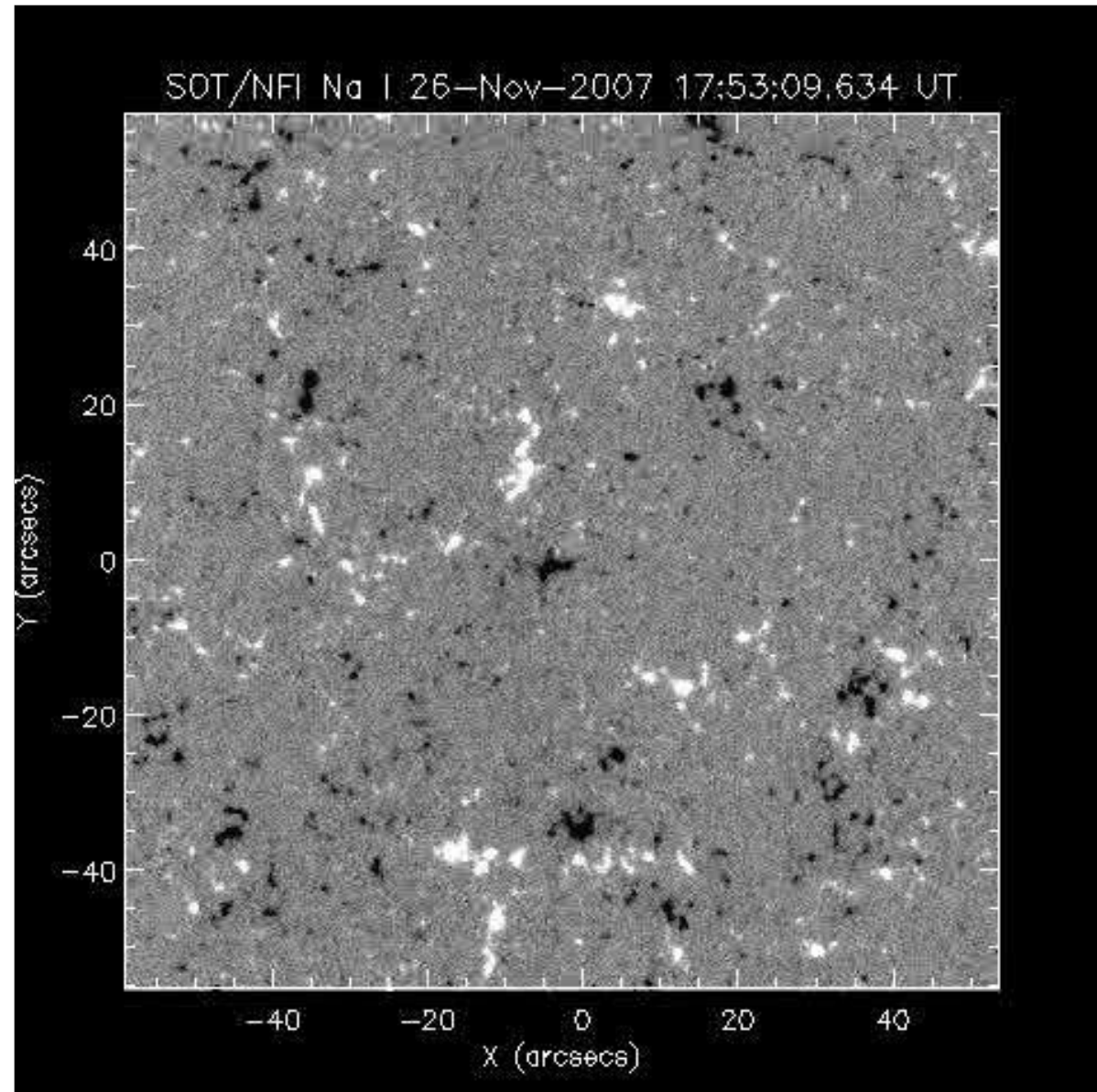




- Markers indicate explosive event inside SOT FOV.
- They occurred near the boundary of network.
→ consistent with previous studies
e.g. Chae (2000), Madjarska & Doyle (2003)

SOT magnetogram

- Stable observation of SOT allows to study dynamic behavior of magnetic fields in a quiet region.
- Fields are gathering in network region.



Flow divergence

- Divergence derived from horizontal flows
- Explosive events preferably occur in converging region of mixed polarities.
- Line indicates EIS slit

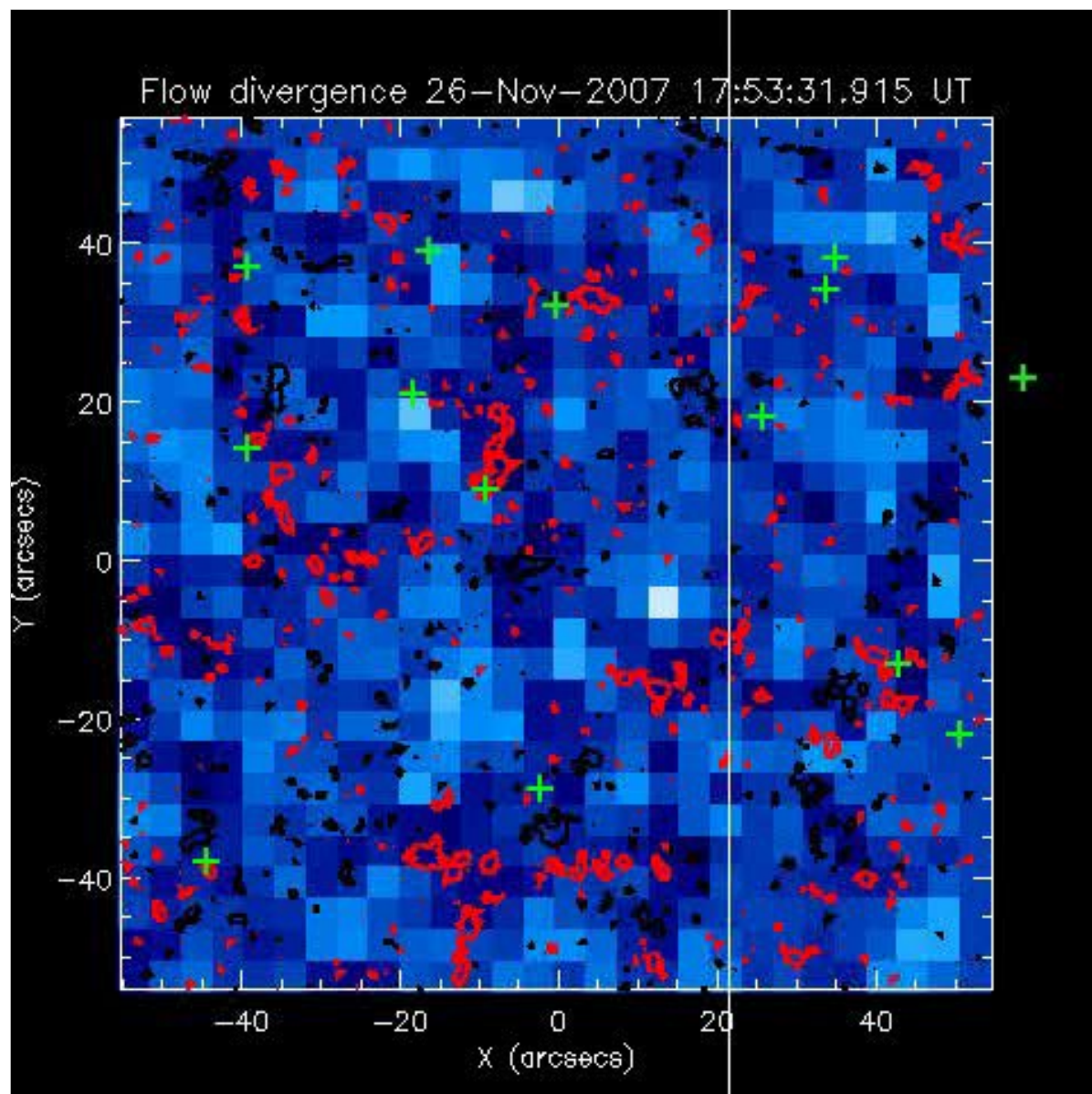
converge \longleftrightarrow diverge



Red: positive flux

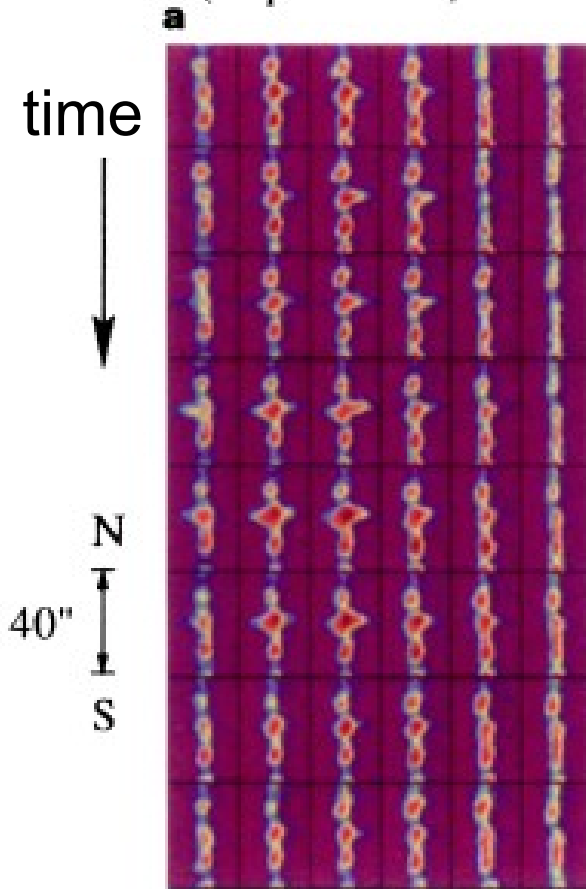
Black: negative flux

Green: explosive events



Need for higher cadence

E-W →
(steps of 1.1")

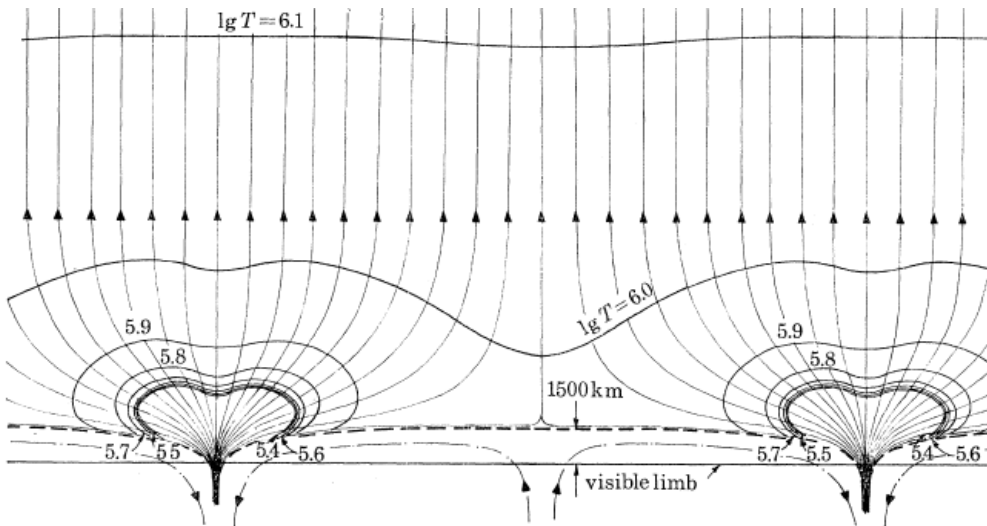


- 10 sec cadence is not sufficient to trace the evolution of the transition region.
- High throughput UV/EUV spectrometer will allow us to observe with **1 sec** exposure.
- One-order improvement in temporal resolution will boost our understanding of the transition region.

Innes et al. (1997)

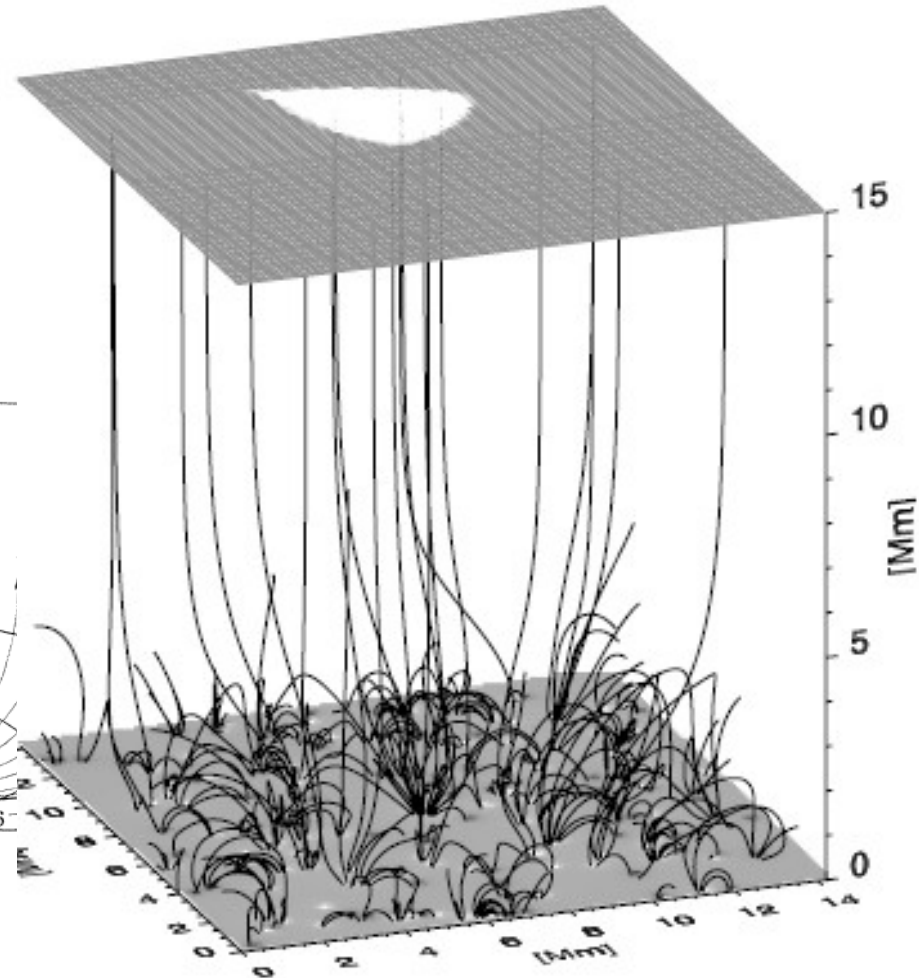
Importance of internetwork fields

- Classical picture:
Network field dominant
- Internetwork fields occupy significant fraction of corona?



Magnetic canopy

Gabriel (1976)



Jendersie and Peter (2006)

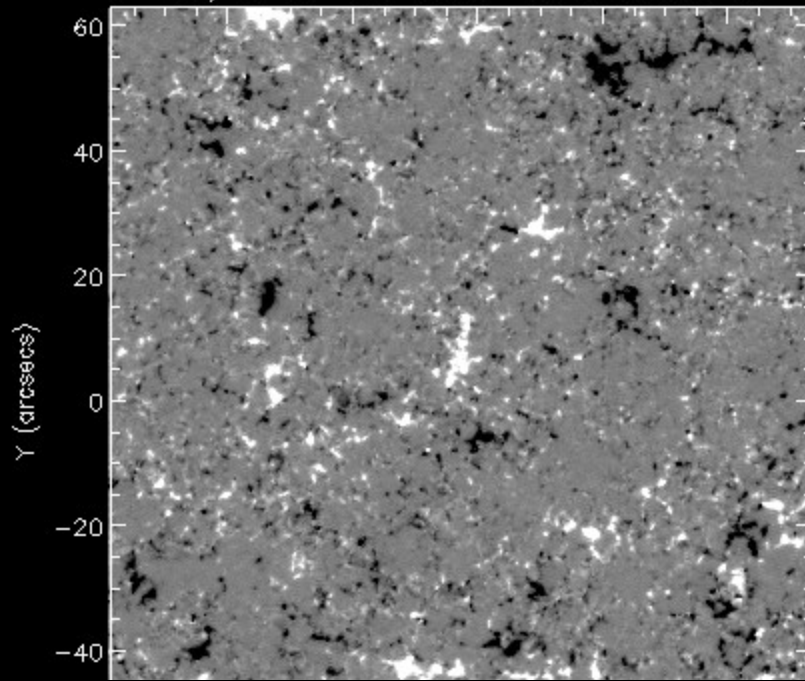
Fields in the chromosphere

- Magnetic field measurements in the photosphere provide only lower boundary condition.
- Field measurements in the chromosphere will give us vital information on the connection between the photosphere and the corona.
- In addition, morphological study of fibril structures will help to understand the magnetic field configuration.

Sensitivity to internetwork fields

- SP can detect weaker magnetic fields than NFI.
- High sensitivity is essential to study weak internetwork fields.

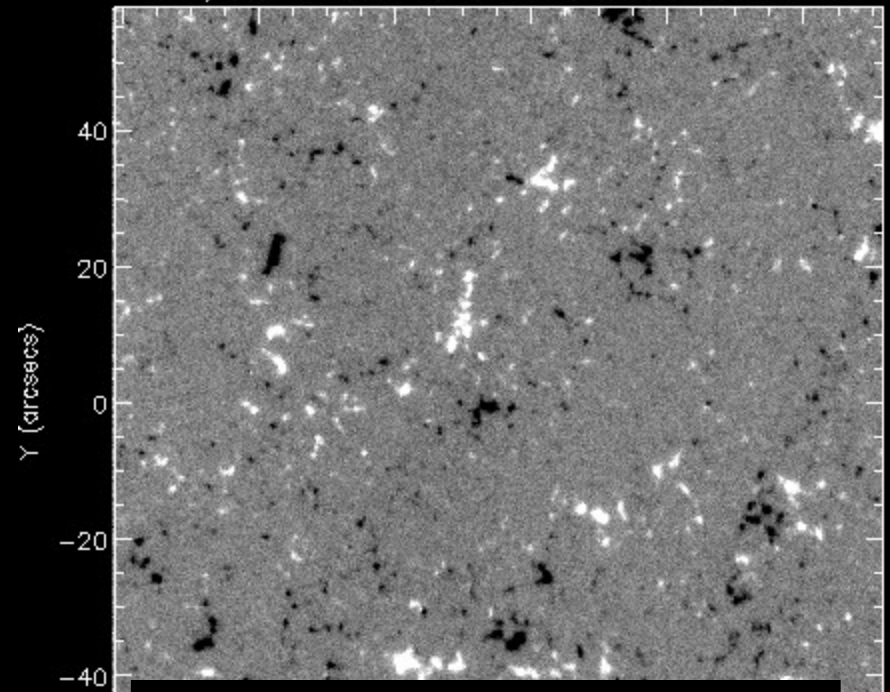
SOT/SP 26-Nov-2007 17:30:00.000 UT



Spectropolarimeter (SP)

X (arcsecs)

SOT/NFI Na I 26-Nov-2007 17:40:38.840 UT



Narrowband Filter (NFI)

X (arcsecs)

Summary

- The transition region and the chromosphere is highly structured and dynamic.
- They are crucial to understand magnetic field connectivity.
- Desired features for Solar-C
 - High throughput UV/EUV spectrometer for better temporal resolution
 - Magnetic field measurement in the chromosphere
 - Sensitivity to weak internetwork fields in the photosphere