



# Morphology and dynamics of photospheric and chromospheric magnetic fields

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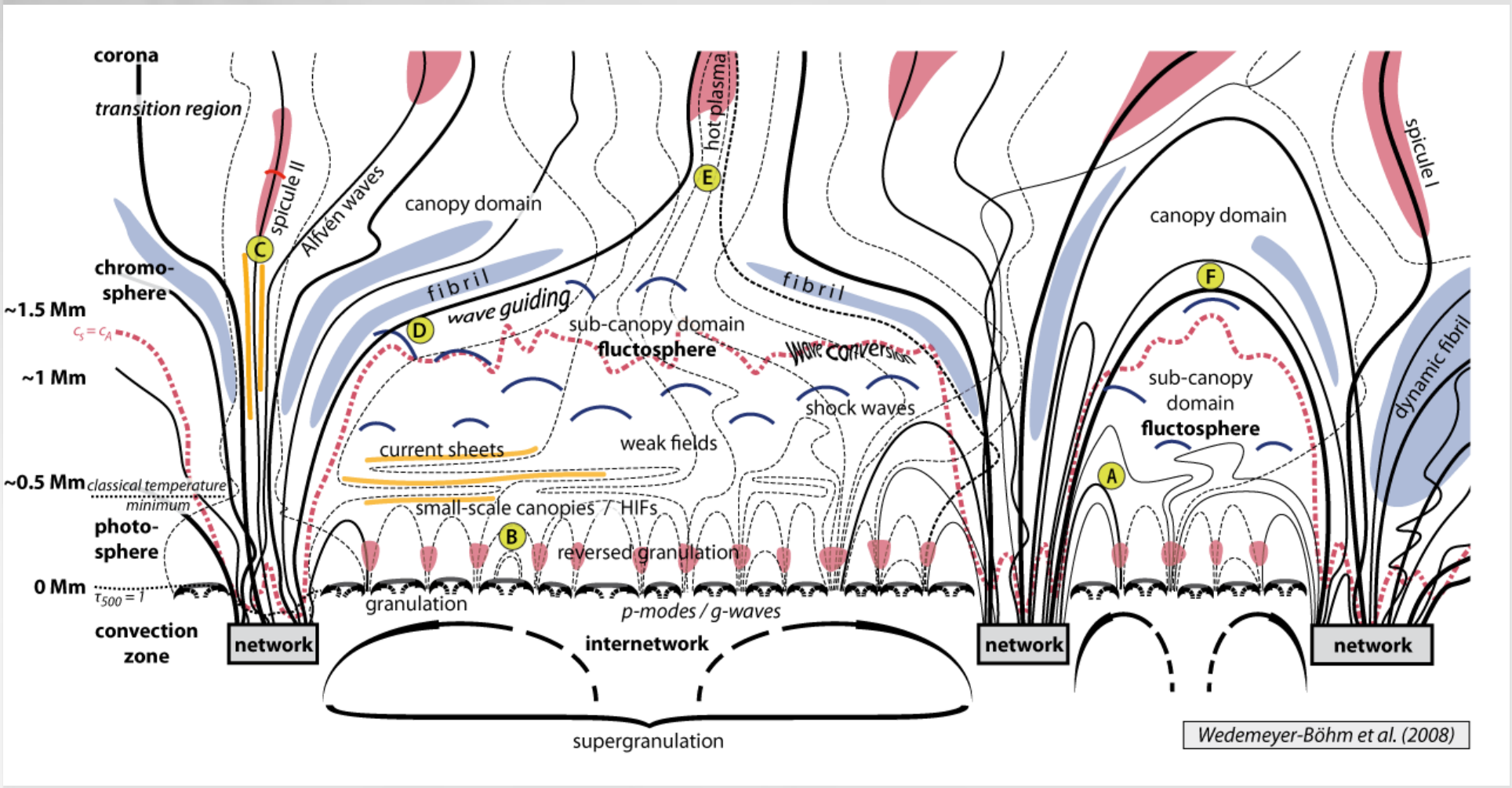
2nd Hinode Science Meeting

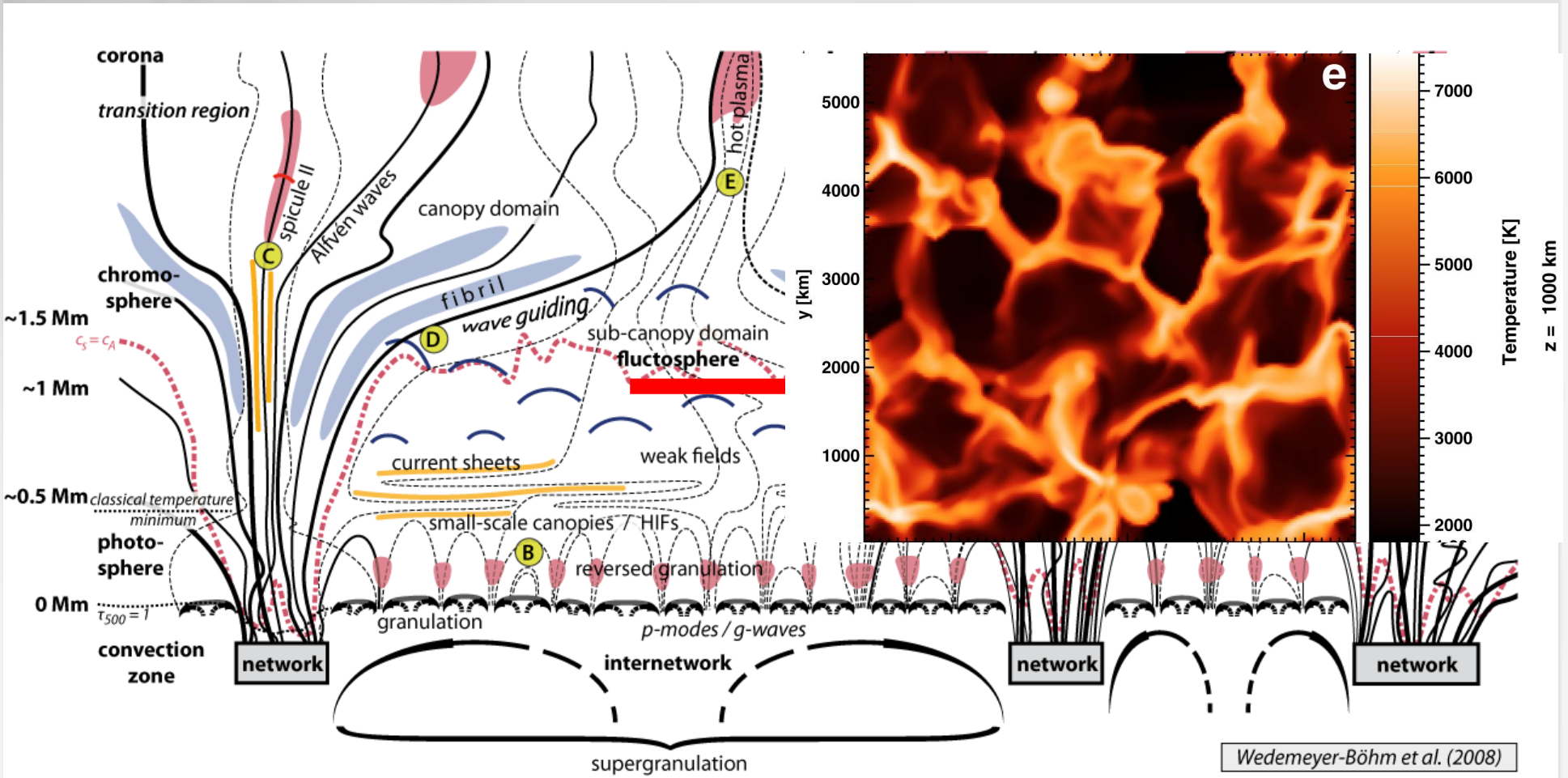
# Overview

- The quiet Sun in the Ca II IR line
- Geometry of a magnetic element in the “fluctosphere”
- Difficulties of spectro-polarimetric observations in the “flucto-” and chromosphere
- Conclusions

# Sketch of the quiet Sun



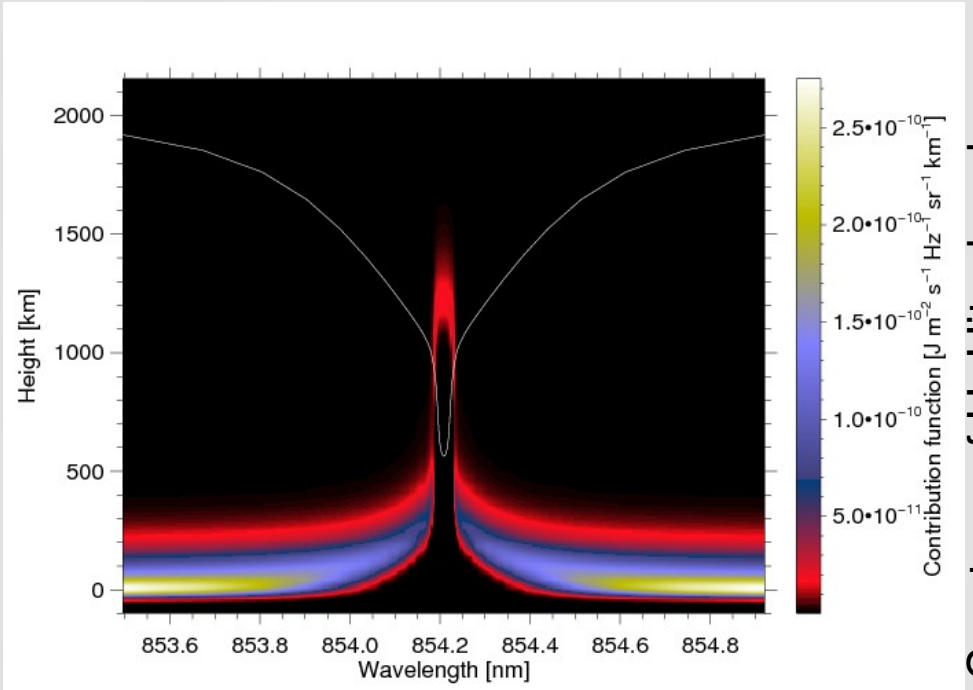
# Sketch of the quiet Sun



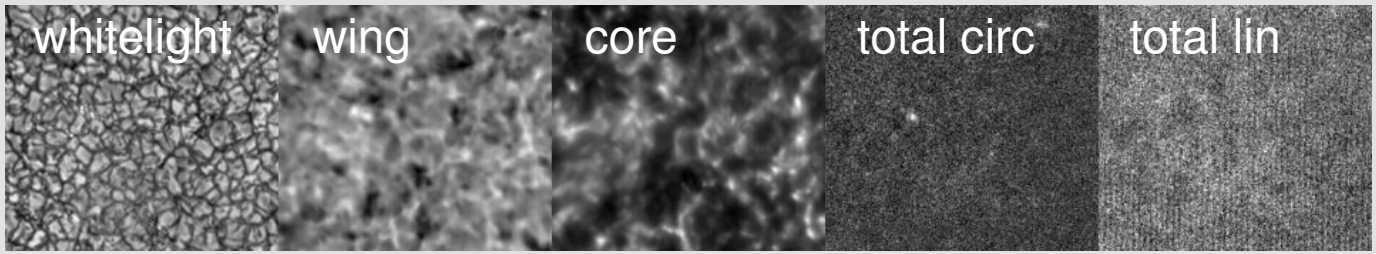
# Quiet Sun

## in Ca II IR (854.2 nm)

- Observations of the quiet Sun, observed with an IBIS and HINODE in a coronal hole at disk center
- Ca II IR line at 854.2 nm
- FWHM: 4.6 pm
- Focus on high cadence: 26.5 s
- Contributions to line core intensity from heights of 1000 – 1500 km
- Contributions to “wing” intensity from heights around 300 km
- In weak-field regions, the 2D auto-correlation of the observed intensity has a typical timescale of 58.5 seconds




Courtesy of H. Uitenbroek



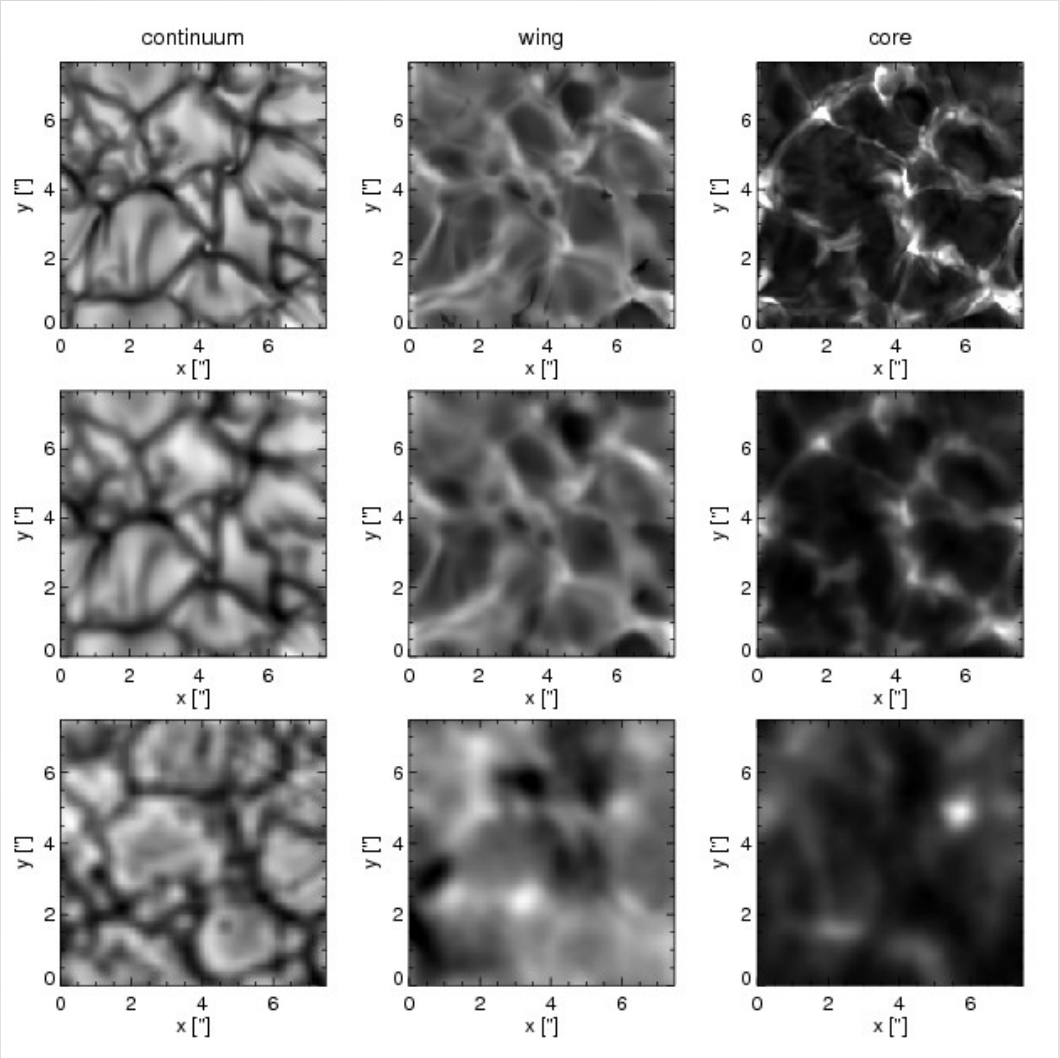
# Quiet Sun

## in Ca II IR (854.2 nm)

CO$^5$BOLD

CO$^5$BOLD &
PSF of DST

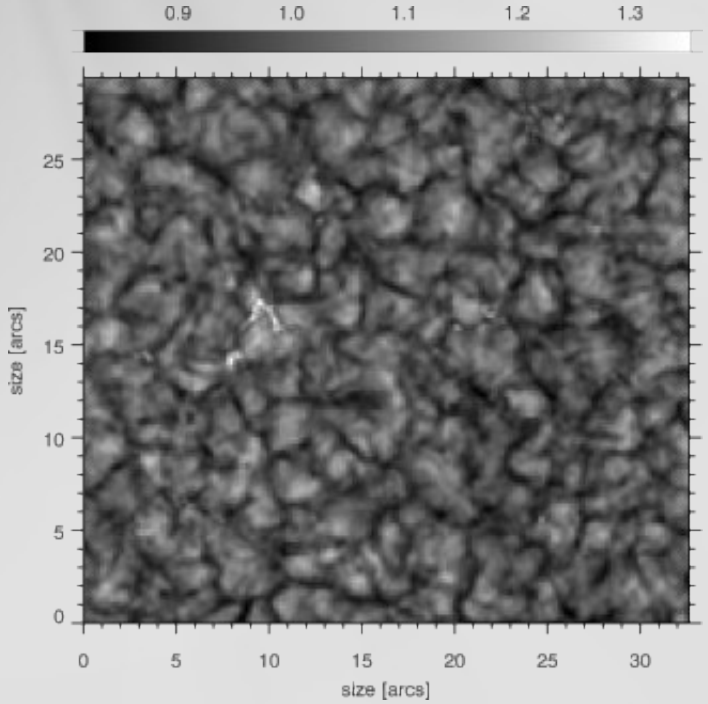
Our IBIS @ DST



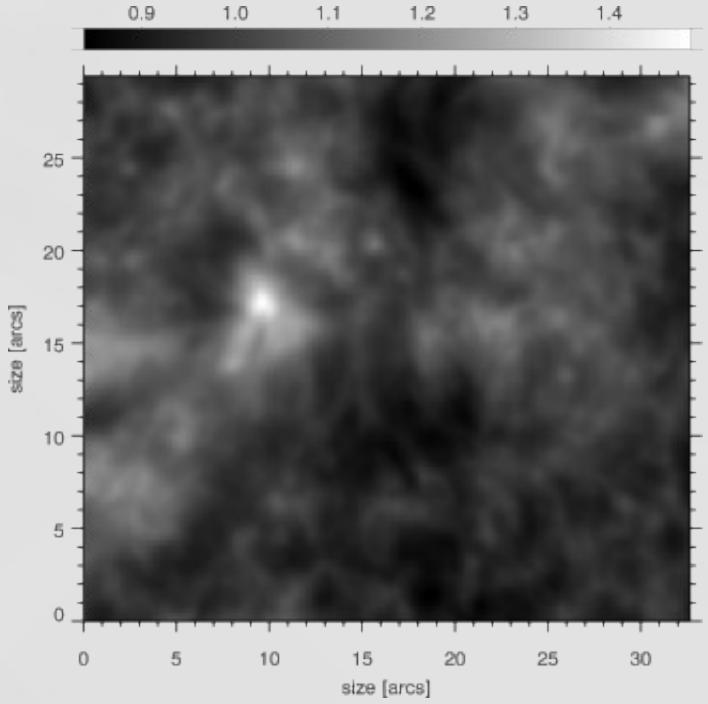

To appear in: Space Science Series of ISSI
S. Wedemeyer-Böhm, Lagg & Nordlund

# Magnetic elements

## in G-band & Ca II IR



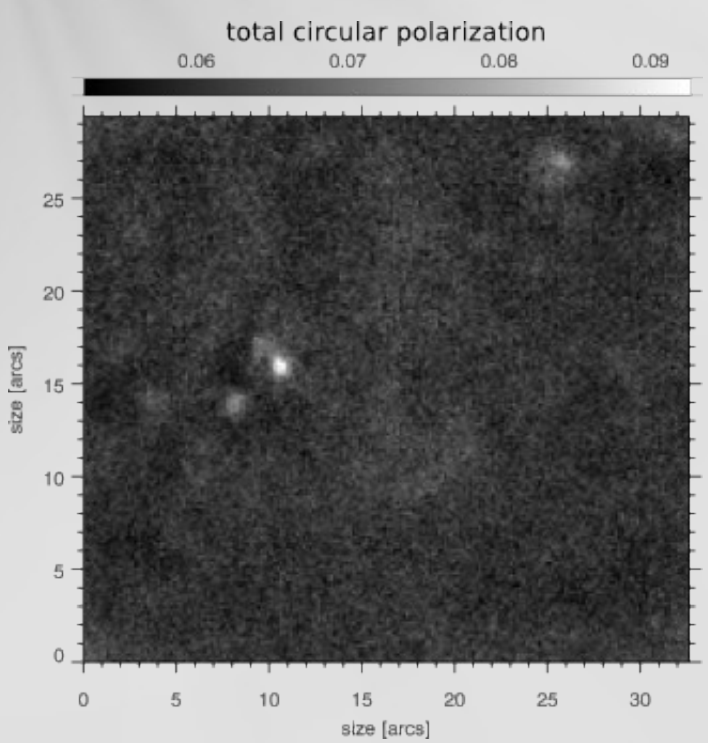

G-band intensity
26.5 min average



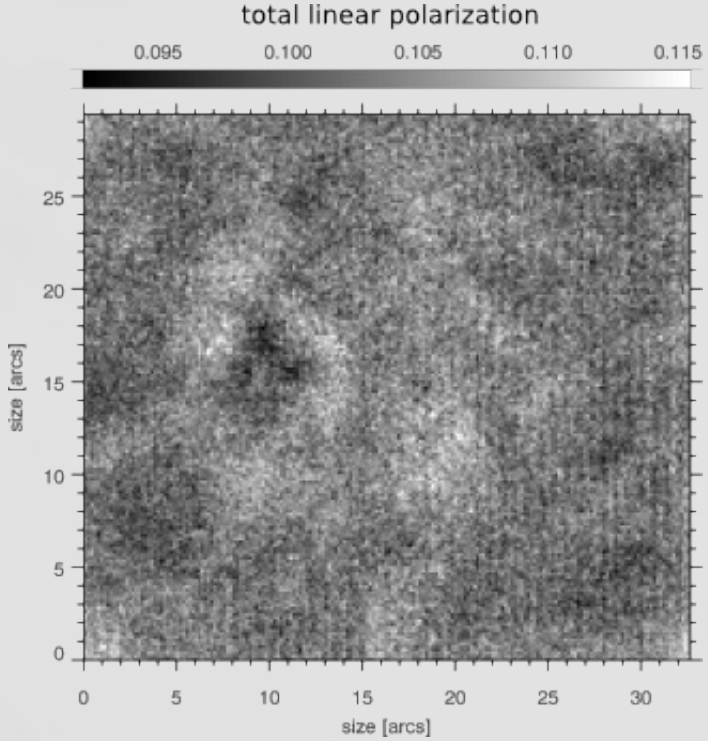

Ca II core intensity
26.5 min average

# Polarization signal

## in the Ca II IR



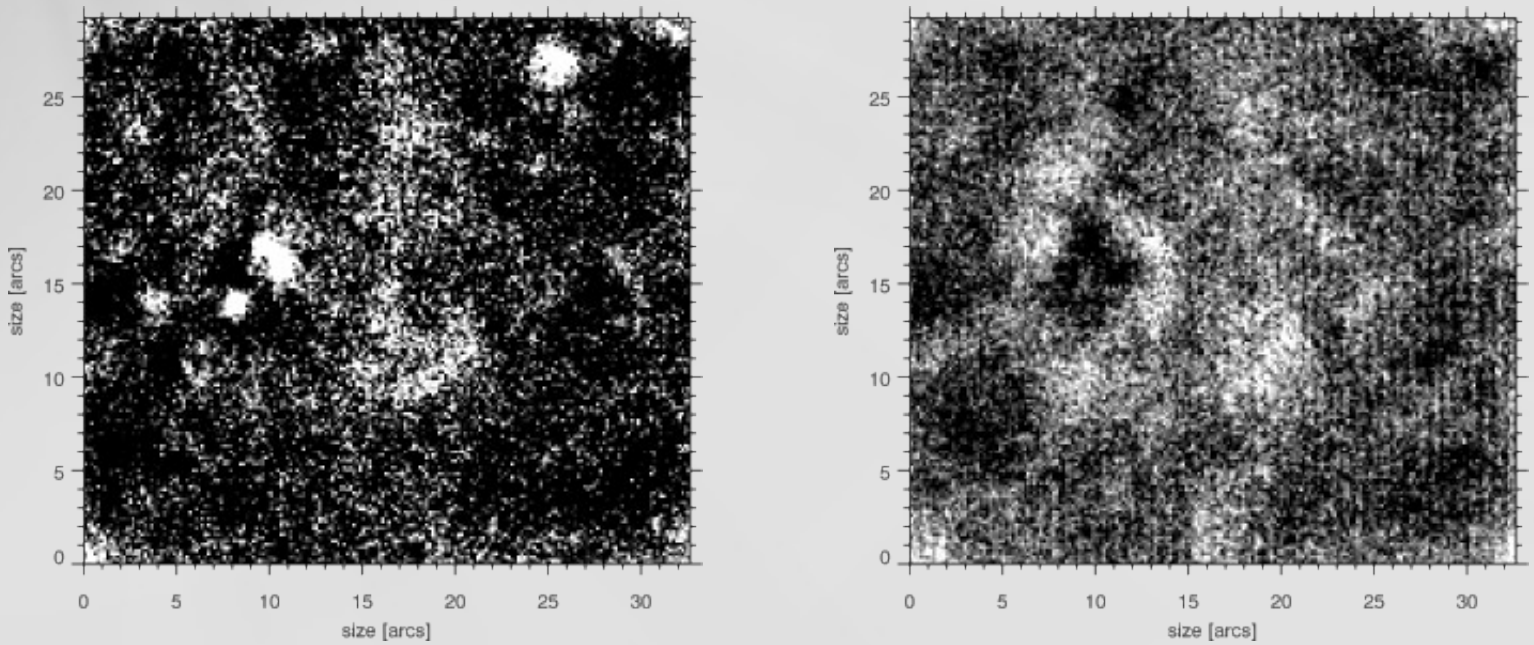

Total circular polarization
26.5 min average




Total linear polarization
26.5 min average

# Polarization signal

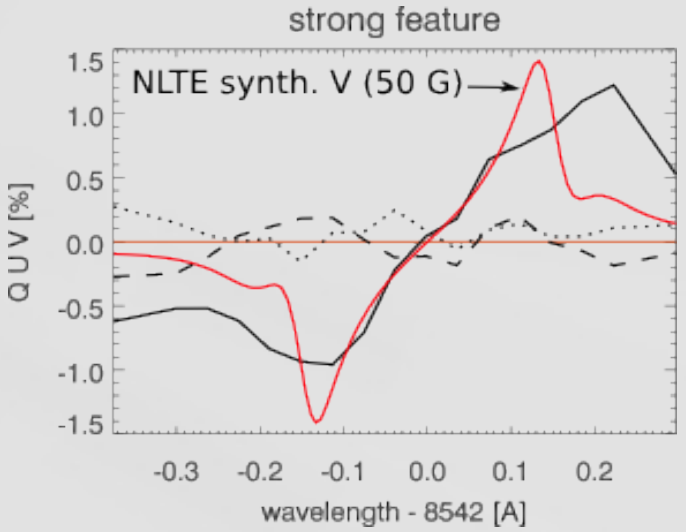
## in the Ca II IR

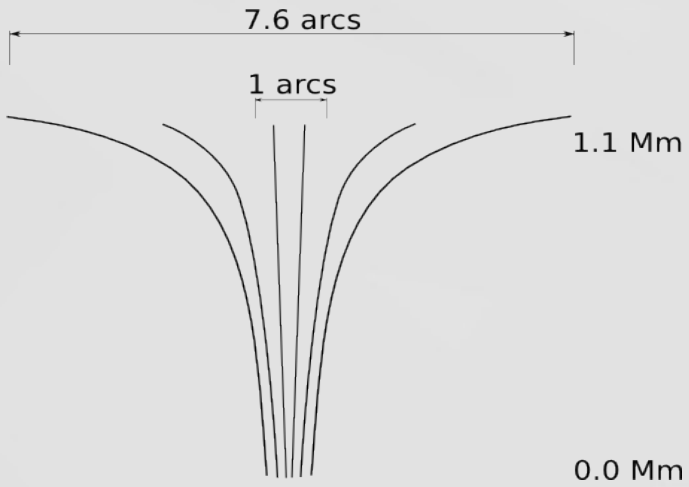



- Size of a single magnetic element in total circular polarization: ~ 1”
- Size of ring structure seen in total linear polarization: ~ 7.6”

# Magnetic element

- Field strength in the strongest feature from NLTE forward model: ~ 50 G
- Field geometry in agreement with earlier measurements (Giovanelli & Jones, 1982)
- The “ring” in total linear polarization could indicate the “canopy” of the strong magnetic feature in the photosphere

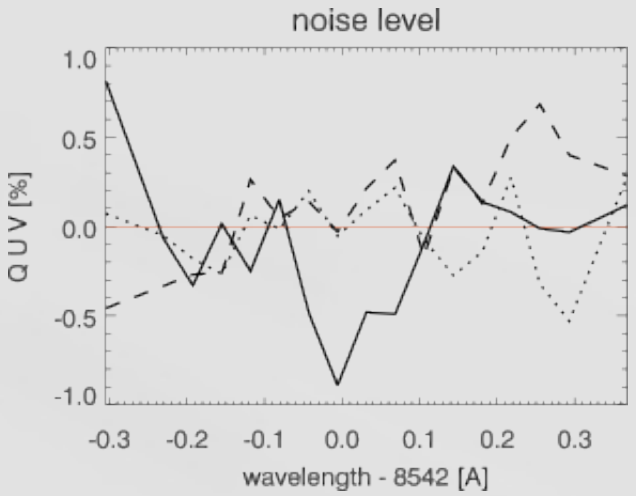


# Exposure time analysis

- Exposure time to detect a 0.2% signal with SNR = 5 using the IBIS at the Dunn Solar Telescope:
  - @ 854.2 nm IBIS gets 500 $e^-$/ms
  - Pure exposure time necessary:

$$t = (4 \cdot 10^{-4})^{-2} / 500\, ms = 12.5\, s$$




- Duty cycle of a camera with an equivalent 12 s exposure?
- Factors of a few might be gained when using less optical elements and more sensitive cameras with better full well capacity but realistically, a significantly larger aperture is needed to capture the dynamics

# Conclusion

- The fluctosphere shows high dynamics that is likely governed by interfering acoustic shock fronts – it shows timescales in intensity below 60 s.
- The magnetic feature observed in this dataset indicates a magnetic canopy structure.
- Observations of the chromospheric magnetic field prove to be very difficult with a spectro-polarimetric instrument. Fast and high QE cameras are needed to increase the duty cycle of such instruments.
- Interpretation of such data is not easy (NLTE!).

# And what in the WORLD is an IBIS at the DST???

The IBIS at the Dunn Solar Telescope welcomes your proposals for the ***service mode*** for the support of your HINODE observations.

Please note Kevin Reardon's poster P5-5!

IBIS = Interferometric BIdimensional Spectrometer