SOLARNET School
“week above the clouds”

(brief) Introduction Philip Lindner

06.08.2019

1. Introduction Philip Lindner

- Home Institute: **Leibniz-Insitut fuer Sonnenphysik (KIS) in Freiburg**

- **Master Thesis in 2018**
- **Working on Phd project since October 2018**

  Supervisors: Nazaret Bello Gonzalez, Rolf Schlichenmaier, Svetlana Berdyguina (official)

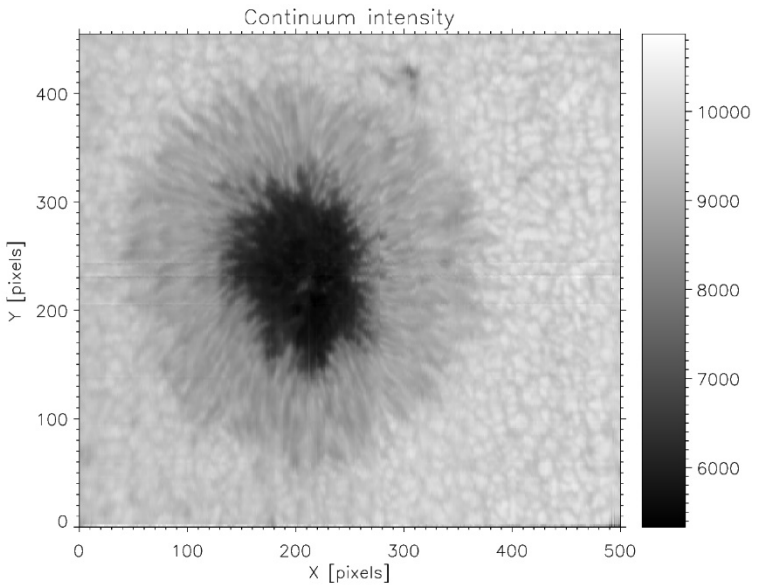
1. Fields of interest

Working title:

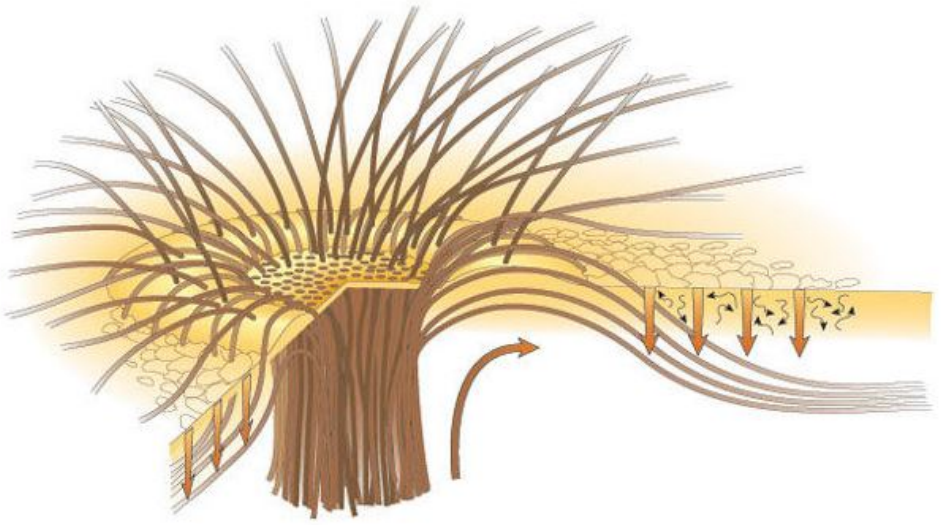
"Coupling between photospheric and chromospheric processes during the evolution of Active Regions"

- **Active Regions: Modes of magneto-convection + Evolution**
- **Photospheric magnetic activity and coupling to chromosphere**
- **Methods: So far: Ground-based observations, Inversion Techniques**

1. Fields of interest



GRIS data, 19sep15.003



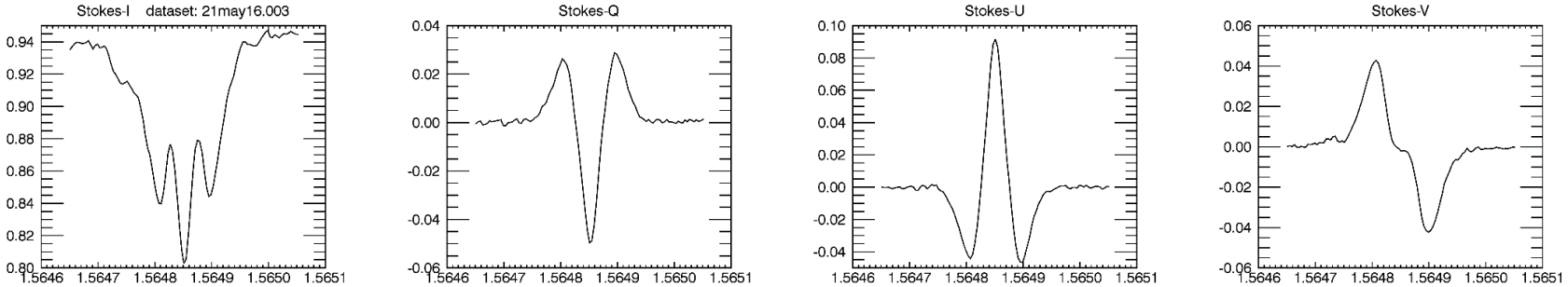
Adapted from Thomas, et al. 2002

- Jurcak 2011: *"The vertical component of the magnetic field* [at the boundary between umbra and penumbra] *is possibly independent of the umbral area"*

- Jurcak et al. 2018: Survey with 88 Hinode scans: Boundary between umbra and penumbra is defined by *"an invariant vertical component of the magnetic field."*

2. Past work

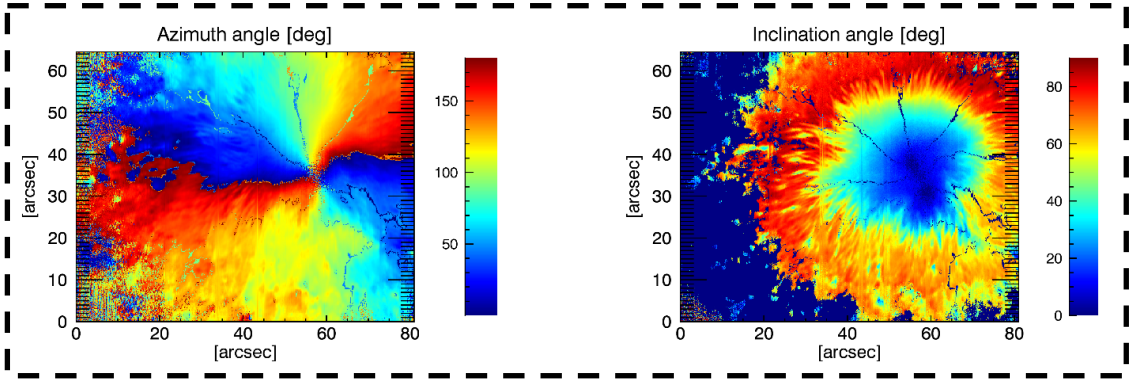
GRIS level1 data (Line: Fe I 15648 Å)

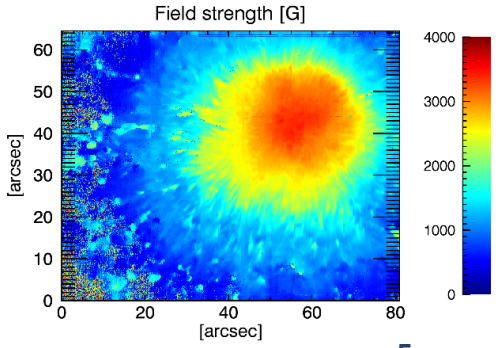


Auer et al. 1977

$$\tan(4\alpha) = \frac{2\sum_i Q_i \cdot U_i}{\sum_i (Q_i^2 - U_i^2)}$$

$$\theta = \cos^{-1}\left(\frac{1}{2}(\sqrt{R^2+4} - R)\right) \qquad R := \frac{\hat{Q}}{\hat{V}}$$

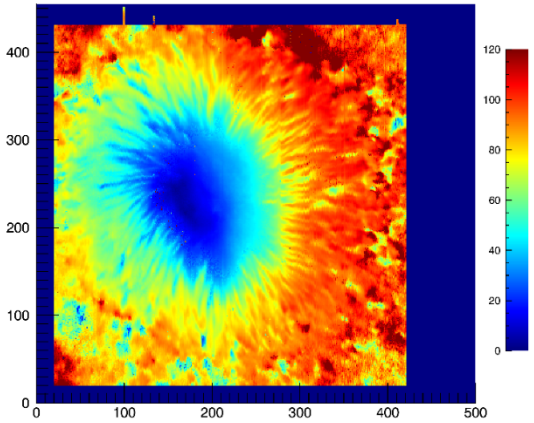


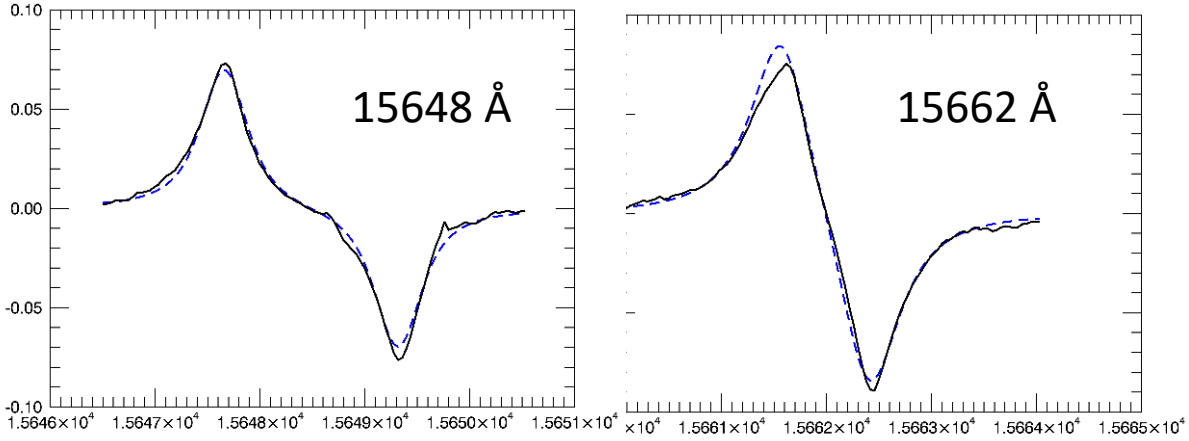


Integrated into the data calibration pipeline for GRIS level2 data

2. Past and current work

- SIR inversions for full maps
- Computationally time consuming
- IDL: Parallelization used for SIR
  => computation time decreased
  to ≈ 1-4 days / dataset





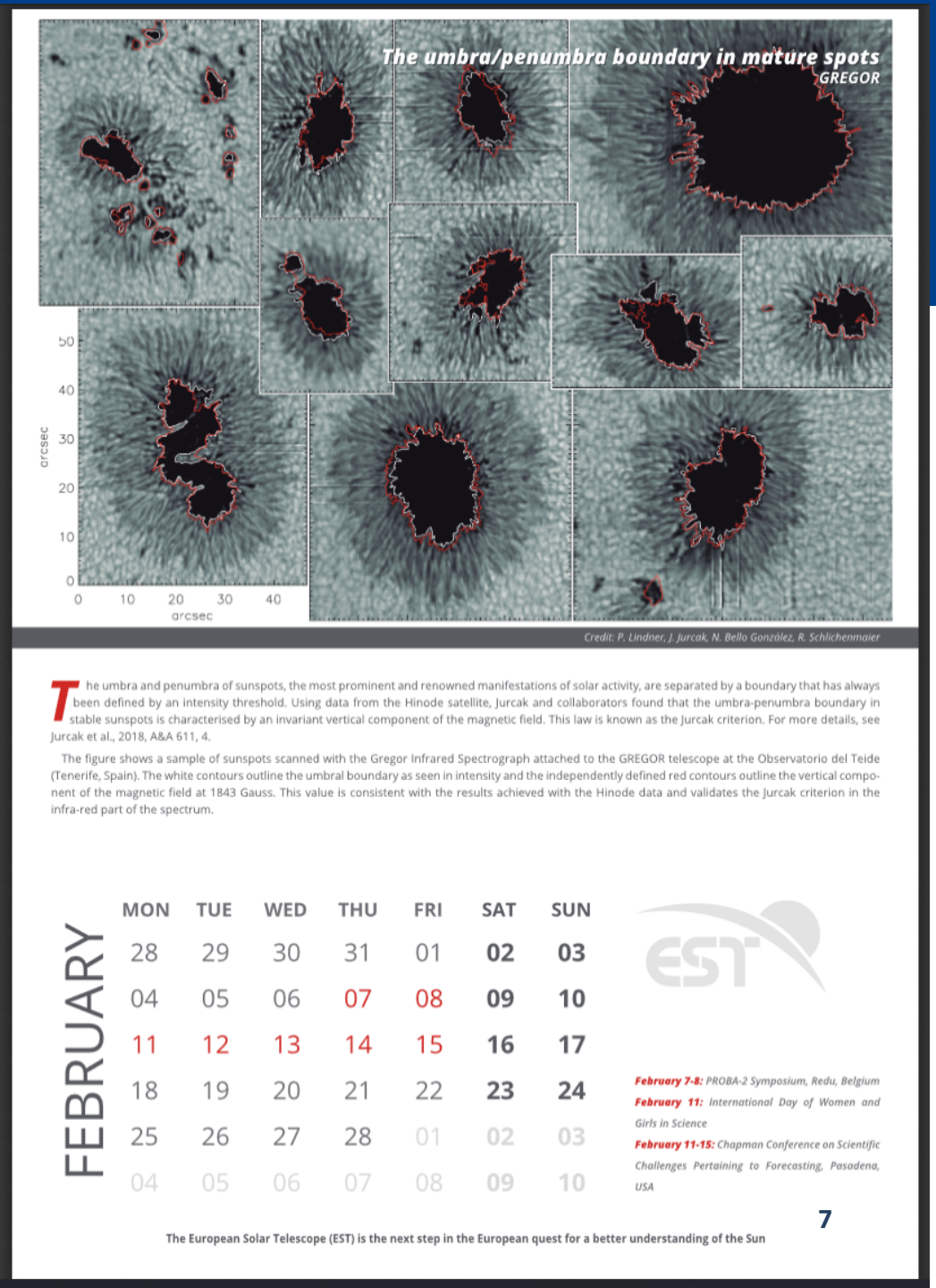
Stokes V, GRIS in black, SIR fit in blue, 19sep15.003

Inclination (SIR), 19sep15.003

2. Past and current wo

- Worked out limitations of Auer method using **synthetic spectra**
- Analyzing $B_\perp$ values at the penumbra/umbra boundary
- Results support existence of a constant value
  $B_\perp = B_{\mathrm{crit}} = (1843\ \mathrm{G}\ ???)$

  Too high!

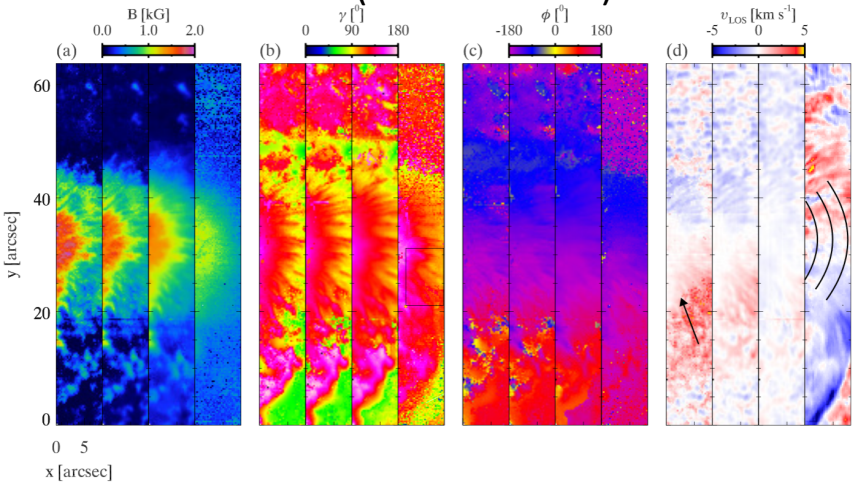


3. Plans for future

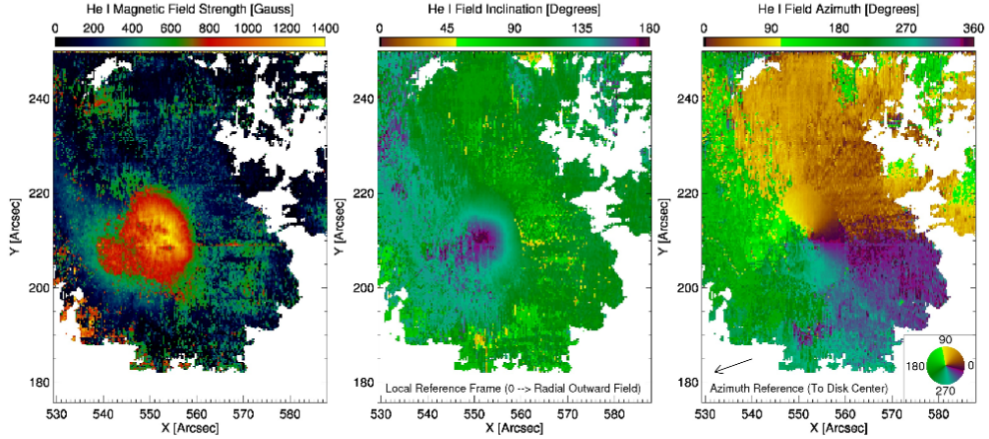
Chromosphere

Already done:

- **Joshi et al. 2016**: (GRIS 10830 Å)



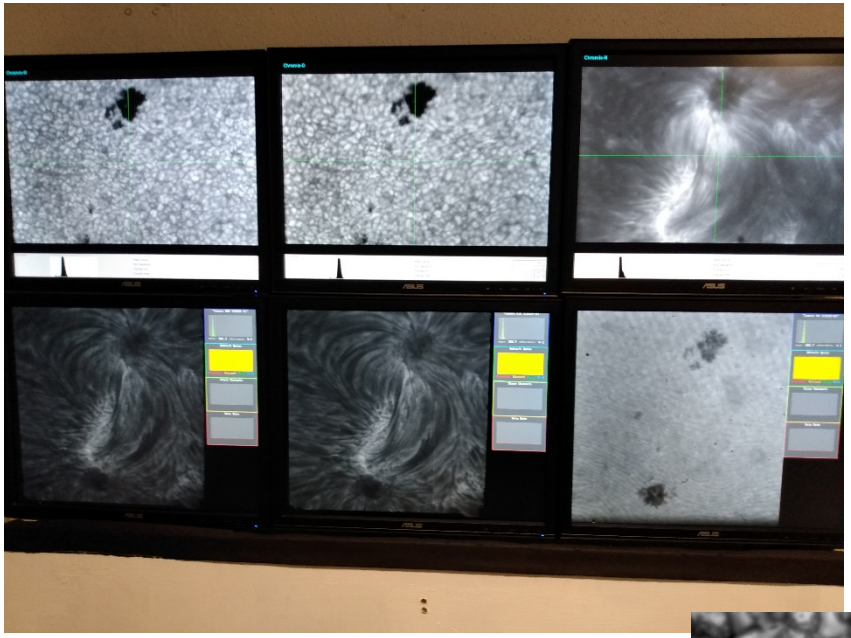
- **Schad et al. 2015**: (DST 10830 Å)



First three maps: Si I and Ca I (SPINOR)
last map: He I triplet (HeLIx+)

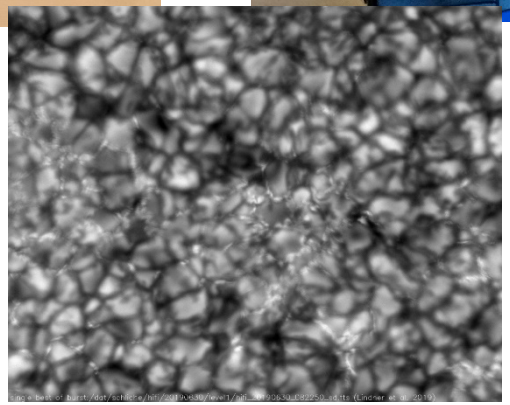
All maps: He I triplet (HAZEL code)

4. Observations



SST (La Palma)

GREGOR



4. Methods

Chromospheric Inversions

- **Plans:**
  - StiC Non-LTE inversion code at Stockholm from Jaime de la Cruz Rodriguez (SOLARNET mobility programme)
  - coupling mechanisms between chromosphere and photosphere

5. Private Interests

Travelling & Mountaineering