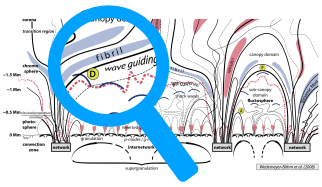
How do fibrils appear in Ca II K data compared to Hα data?

Sepideh Kianfar[1], Jorrit Leenaarts[1], Jaime de la Cruz Rodríguez[1]

[1] Institute for Solar Physics, Department of Astronomy Stockholm University, Albanova University Center, SE–10691 Stockholm, Sweden

Stockholm University
The Institute for Solar Physics
INSTITUTET FÖR SOLFYSIK

Introduction



Observations show that fibrils cover most of the chromosphere in line core images in Ca II H&K and Hα. In this project, we investigate fibrils that appear bright in wavelength-integrated Ca II K images. They are bright because their K2 intensity is higher than their surroundings. The width of the central reversal in the fibrils is the same. A fraction of these bright fibrils has a clear counterpart in Hα. Those that do also appear bright in the Hα line core.

Observations

- Observed by the Swedish 1-m Solar telescope (SST)
- On 2016-09-15, at 08:49:51 UT
- Field of view of 63″ × 42″ at disk center
- Targeted a plage region at the location of a decayed active region
- Instruments:
  - CRisp Imaging SpectroPolarimeter (CRISP) → *Fe I 6301–2, Ca II 8542 & Hα lines*
  - CHROMospheric Imaging Spectrometer (CHROMIS) → *Ca II K line*

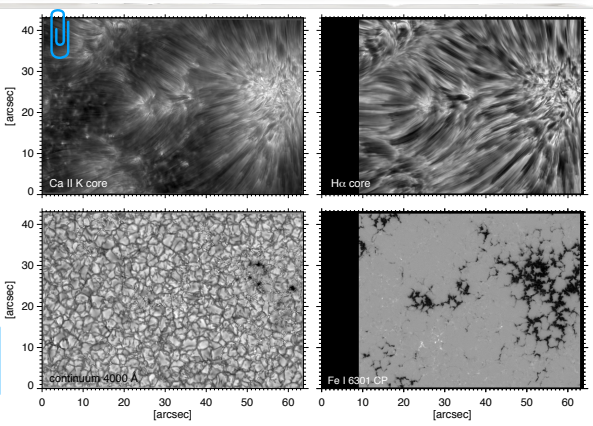


Figure 1. The observed plage region from which the bright fibrils originated.

Results

- Single scan with the best seeing condition
- Integrated over the near–core wavelength positions
- Unsharp–masked

Path of 50 bright fibrils are chosen in Ca II K map

Neighbouring dark background is defined

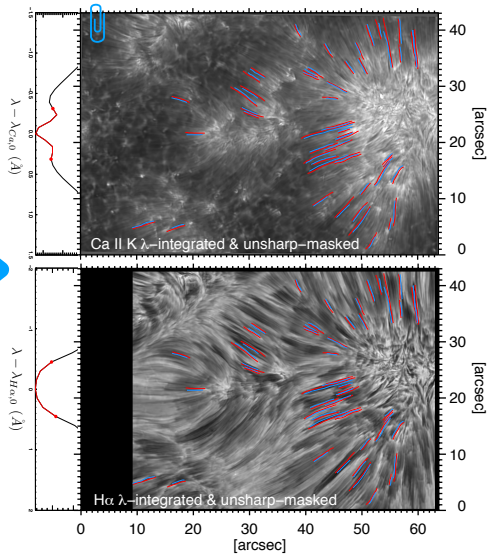


Figure 2. Over-plotted paths of selected fibrils (red) and the neighbouring dark background (blue). The wavelength-integration range is shown at the left side of the maps.

- Fibrillar structures are only bright in the very core of the Ca II K line.
- The central reversal is generally the same as in the region next to it: red→ fibril, blue→ background

⇒ *This suggests that they only exist higher up in the chromosphere*

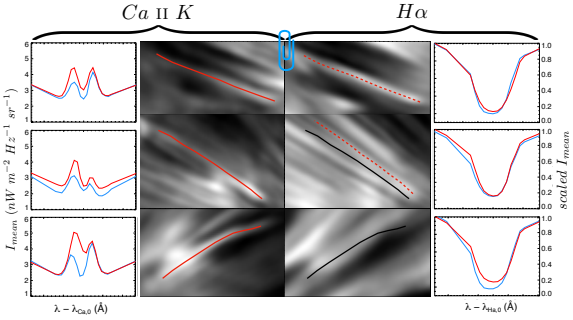
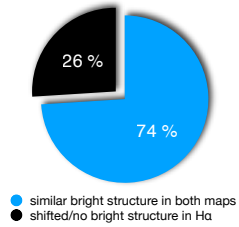


Figure 3. Spectral profile of the bright fibrils sample, appearing in Ca II K, in comparison to Hα. The fibrillar paths are over plotted on wavelength–integrated and unsharp–masked maps.

- Most of the bright fibrils in the selected sample have the same bright structure in Hα



Discussion

We compared our results with Ca II K and Hα images computed from a 3D radiation-MHD simulation with the *Bifrost* code (See figure 4).

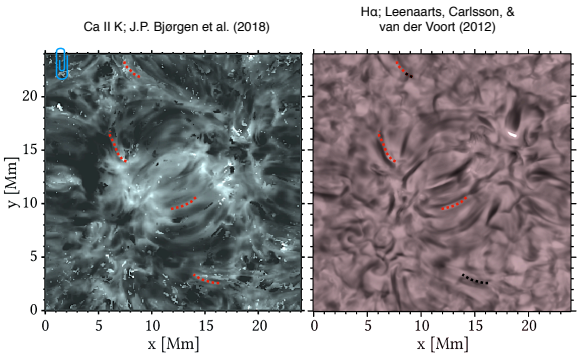


Figure 4. Bright fibrils as they appear in Ca II K simulations in comparison to Hα simulations.

The simulation contains some fibrils, but not as many as in the observations, especially in the case of the bright fibrils. A few bright fibril—like structures are indicated with red dashed lines.

As a next step, we will determine the atmospheric structure at the location of the observed bright fibrils and their neighbouring background by running non-LTE inversions. We so aim to understand the nature and origin of bright fibrils.

References

Leenaarts, J., Carlsson, M., & Rouppe van der Voort, L. 2012, ApJ, 749, 136

Bjørgen, J. P., Sukhorukov, A. V., Leenaarts, J., et al. 2018, A&A, 611, A62

de la Cruz Rodríguez, J., Leenaarts, J., & Asensio Ramos, A. 2016, ApJ, 830, L30

IRIS-9, Göttingen, 25-29 June 2018

Poster

2. Chromospheric heating and dynamics

How Fibrils Appear in the Ca II K Data in Comparison to Hα Data

Sepideh Kianfar[1], Jorrit Leenaarts[1], Jaime de la Cruz Rodríguez[1]

[1] *Institute for Solar Physics, Department of Astronomy Stockholm University, Albanova University Center, SE–10691 Stockholm, Sweden*

Observations show that fibrils cover most of the chromosphere in line–core images in Ca II H&K and Hα. We observed these lines with the Swedish 1–meter Solar Telescope using the CHROMIS and CRISP imaging spectrographs. We investigate fibrils that appear bright in wavelength–integrated Ca II K images. They are bright because their K2 intensity is higher than their surroundings. The width of the emission peaks in the fibrils is the same as in their surroundings. Only a fraction of the fibrils has a clear counterpart in Hα. Those that do also appear bright in the Hα line–core. We will discuss possible explanations for this behavior.