A study of plasma β in Quiet Sun: multi-instrument view

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Observational campaign HOP 381, 10 – 22 October 2019



SDO AIA Fe XII (193 Å) 19-Oct-2019 23:31:04.840

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10-18 Oct center [0",0"] and **19-22 Oct** center [0",500"]

Ground-based

- High-resolution Fast Imager (HIFI at GREGOR)
- The GREGOR Infrared Spectrograph (GRIS)

Satellite

- The Interface Region Imaging Spectrograph (IRIS)
- The Extreme-ultraviolet

Imaging Spectrometer (Hinode-EIS)

- The Solar Optical Telescope (Hinode-SOT)
- XRT -X-Ray Telescope



High-resolution Fast Imager (HIFI at GREGOR)



De Boer et al. (1997) methodology

Wien's approximation



Where I_{Gband} and I_{Blue} corresponds to the HIFI intensity of the blue continuum and G-band at 450.5 nm and 430.7 nm, respectively.

$$T_{Blue} = \frac{2.897 \times 10^6 nm K}{\lambda_{Blue}}$$

$$T_{Gband} = \frac{2.897 \times 10^6 nm K}{\lambda_{Gband}}$$

The percentage error was calculated at each case

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Plasma β in the photosphere





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October 13 08:55:15 UT

October 13 09:04:51 UT



Our results were plotted over Figure 3 of Gary (2001)



Plasma $\boldsymbol{\beta}$ in the photosphere

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The Interface Region Imaging Spectrograph (IRIS)

October 19, 2019 from 11:33:14 to 11:37:18 UT



Diagnostic of the electron density using the intensities of the lines O IV 1399.77 A and 1401.16 A

 $N_{e}^{=}$ 10¹⁰ cm⁻³ and 10¹² cm⁻³



The Extreme-ultraviolet Imaging Spectrometer (Hinode-EIS)



Diagnostic of the electron density using the intensities of the lines Fe XII 186 A and 195 A

October 17, max
$$N_e^{= 10^{12} \text{ cm}^{-3} \text{ mean } N_e^{= 10^{8.9} \text{ cm}^{-3}}$$

October 19, max $N_e = 10^{12} \text{ cm}^{-3} \text{ mean } N_e = 10^{8.7} \text{ cm}^{-3}$

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- Temperature estimation using HIFI-GREGOR datasets shows expected values in the photosphere. This technique can be applied to different ground-based datasets.
- Plasma β values obtained through HIFI, HMI/SDO and FALC model show expected values in magnetic field regimes 5-50 G and >50-150 G
- Density estimations in transition region using IRIS datasets agree within reported values, e.g., Polito et al. 2016
- Density values obtained through EIS datasets are consistent to reported values, e.g., Rodríguez Gómez et al.
 2018 (CODET model)

Next steps

• Obtain Plasma β values:

Photosphere: SIR code - GRISChromosphere: Hazel code - GRISTransition region (PFSS)Corona (AIA DEMs and PFSS)