

Multi-Wavelength Tomography of the Solar Corona: First Steps

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Resumen /

Abstract / *Solar rotational tomography* (SRT) is an observational technique of the solar corona that allows reconstruction of the three-dimensional (3D) distribution of some of its fundamental physical parameters at a global scale. In particular, it allows determination of the 3D distribution of the coronal electron density. Applied to white-light data, SRT density results are of an absolute nature, while applied to extreme ultraviolet (EUV) data they scale with the square root of the iron (Fe) abundance. EUV tomography is routinely applied to EUVI/STEREO and AIA/SDO data, covering the heliocentric height range 1.02 to 1.25 R_{sun}. That height range overlaps the field of view of the white light KCOR/HAO coronagraph, which covers the height range 1.05 to 3.0 R_{sun}. In this work we present first results of comparing simultaneous tomographic reconstructions of the coronal electron density based on the aforementioned instruments. This is the first step throw *Multi-Instrumental Tomography* (MIT) technique, which aims to perform simultaneous tomographic reconstruction for lasco-C2, K-cor, Ucomp and AIA or EUVI to obtain temperature and electron density, iron abundances.

Keywords / Sun: corona – Sun: activity – Sun: UV radiation – Sun: magnetic fields

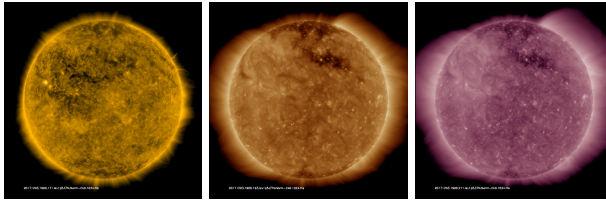


Fig. 1: AIA/SDO.

1. Introduction

Un estudio en radiancia de luz blanca de van der Holst et al. (2014)

2. Method

Utilizando una serie temporal de imágenes EUV que cubren una rotación solar completa, la técnica DMT permite reconstruir la distribución 3D de la emisividad en cada banda del telescopio EUV. Los valores de emisividad se obtienen en una malla esférica que cubre alturas de 1.0 a 1.25 R_☉ con celdas de tamaño 0.01 R_☉ en dirección radial y 2° en direcciones angulares.

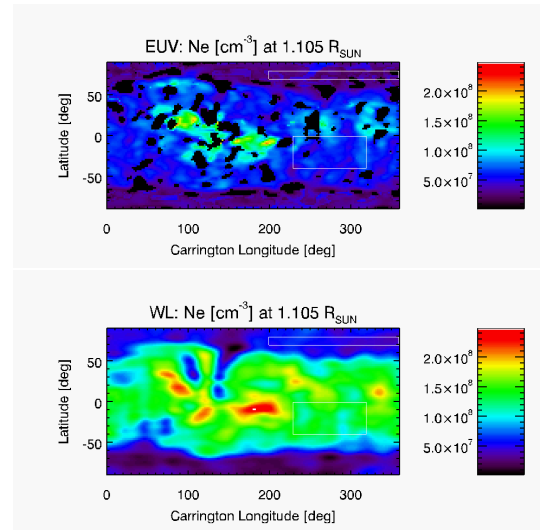


Fig. 2: AIA/SDO.

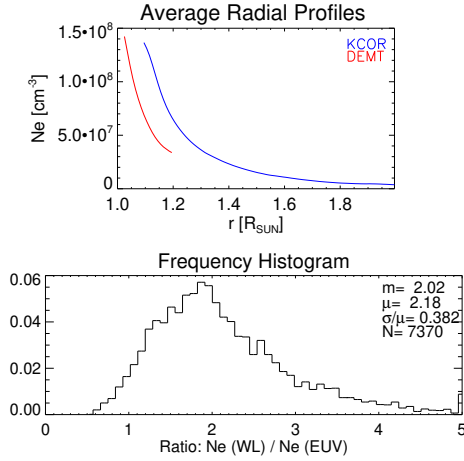


Fig. 3: AIA/SDO.

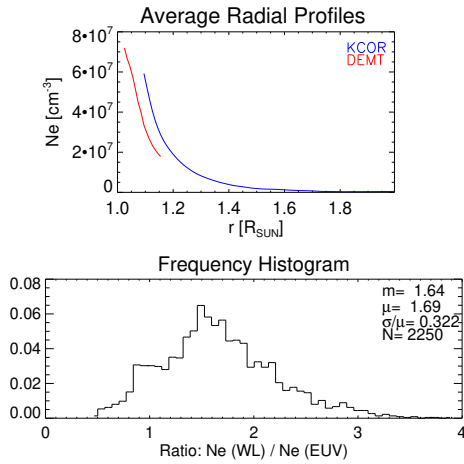


Fig. 4: AIA/SDO.

3. Results

4. Conclusions and future efforts

- $E_{\text{EUV}} \propto \langle N_e^2 \rangle = f \langle N_e \rangle^2$, where **filling factor** is defined as $f \equiv \langle N_e^2 \rangle / \langle N_e \rangle^2$
- $E_{\text{WL}} \propto \langle N_e \rangle$
- Then: $\langle N_e \rangle_{\text{WL}} / \langle N_e \rangle_{\text{EUV}} \propto \sqrt{f}$
- If differences in the results are solely attributed to filling factor:
 $f \sim 2$ in subpolar open region, and $f \sim 4$ in quiet sun closed region.
- Note that: $\sigma_{N_e}^2 \equiv \text{Var}N_e = \langle N_e^2 \rangle - \langle N_e \rangle^2 = \langle N_e \rangle^2 (f - 1)$
- So that: $\sigma_{N_e} / \langle N_e \rangle = \sqrt{f - 1}$.
- With this interpretation, where f is larger (quiet sun closed region) the electron density probability distribution has larger variance.

References

van der Holst B., et al., 2014, ApJ, 782, 81