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Multi-Wavelenght Tomography of the Solar Corona: First Steps

D.G. Lloveras[1], A.M. Vásquez[1,2,3], Enrico Landi[4], Richard A. Frazin[4]

[1] *Insituto de Atronomía y Física del Espacio (CONICET-UBA), Buenos Aires, Argentina*
[2] *Departamento de Física, Facultad de Ciencias Exactas y Naturales (UBA), Buenos Aires, Argentina*
[3] *Departamento de Ciencia y Tecnología (UNTREF), Buenos Aires, Argentina*
[4] *Department of Climate ande Space Sciences and Engineering (CLaSP), University of Michigan, Ann Arbor, Michigan, USA.*

Contact / dlloveras@iafe.uba.ar

Resumen / Aca va el resumen en espaniol

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 Rsun. 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 Rsun. In this work we present first results of comparing simultaneous tomographic reconstructions of the coronal electron density based on the aforementioned instruments. We study the distribution of Fe abundance in both magnetically open and closed field structures. Our effort aims at helping to determine the absolute value of the First Ionization Potential (FIP) bias, discriminating whether the FIP effect consists of an enhancement of low-FIP elements, a depletion of high-FIP elements, or a combination of both.

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

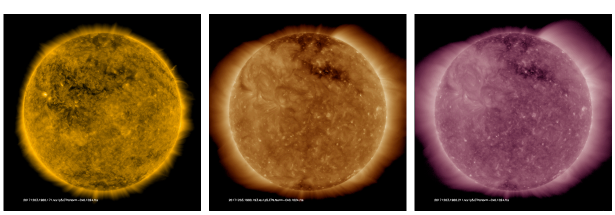

Figure 1: AIA/SDO.

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 DEMT 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 $R_\odot$ con celdas de tamaño 0.01 $R_\odot$ en dirección radial y 2° en direcciones angulares.

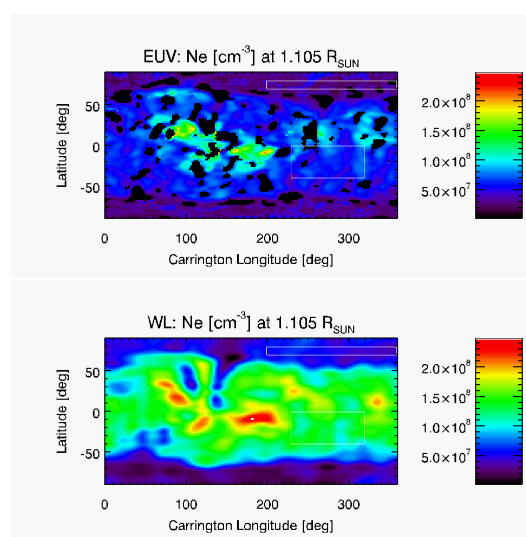

Figure 2: AIA/SDO.

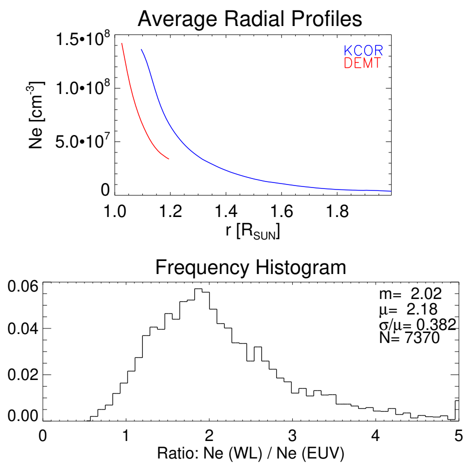

Figure 3: AIA/SDO.

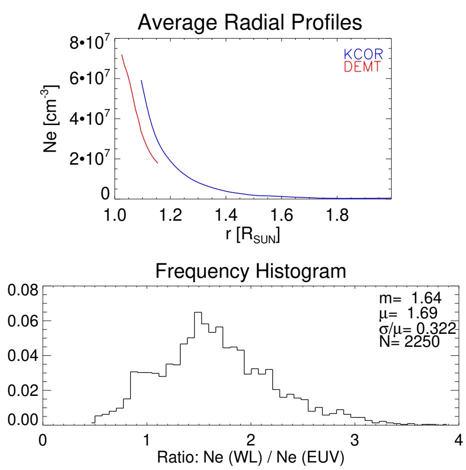

Figure 4: AIA/SDO.

3. Results

4. Conclusions and future efforts

- $E_{\rm EUV} \propto \left\langle N_e^2 \right\rangle = f\ \langle N_e \rangle^2$, where filling factor is defined as $f \equiv \left\langle N_e^2 \right\rangle / \langle N_e \rangle^2$
- $E_{\rm WL} \propto \langle N_e \rangle$
- Then: $\langle N_e \rangle_{\rm WL} / \langle N_e \rangle_{\rm EUV} \propto \sqrt{f}$
- 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: $\sigma_{Ne}^2 \equiv \mathrm{VarN_e} = \left\langle \mathrm{N_e^2} \right\rangle - \langle \mathrm{N_e} \rangle^2 = \langle \mathrm{N_e} \rangle^2\ (\mathrm{f}-1)$
- So that: $\sigma_{Ne} / \langle N_e \rangle = \sqrt{f-1}$.
- 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