Solar Phys (2017) 292:177
DOI 10.1007/s11207-017-1203-3

RADIO AND SPACE-BASED OBSERVATIONS

Addendum to: Strength of the Solar Coronal Magnetic Field – A Comparison of Independent Estimates Using Contemporaneous Radio and White-Light Observations

Anshu Kumari[1] · R. Ramesh[1] · C. Kathiravan[1] · T.J. Wang[2]

Published online: 21 November 2017

Abstract This addendum uses an alternate fit for the electron density distribution $N(r)$ (see Figure 1) and estimates the coronal magnetic field using the new model. We find that the estimates of the magnetic field are in close agreement using both the models.

We have fit the $N(r)$ distribution obtained from STEREO-A/COR1 and SOHO/LASCO-C2 using a fifth-order polynomial (see Figure 1). The expression can be written as

$$N_{\mathrm{cor}}(r) = 1.43 \times 10^9 r^{-5} - 1.91 \times 10^9 r^{-4} + 1.07 \times 10^9 r^{-3} - 2.87 \times 10^8 r^{-2} + 3.76 \times 10^7 r^{-1} - 1.91 \times 10^6, \quad (1)$$

where $N_{\mathrm{cor}}(r)$ is in units of cm^{-3} and r is in units of $\mathrm{R}_\odot$. The background coronal electron density is enhanced by a factor of 5.5 at 2.63 $\mathrm{R}_\odot$ during the coronal mass ejection (CME). The estimated coronal magnetic field strength (B) using radio data indicates that $B(r) \approx (0.51 - 0.48) \pm 0.02$ G in the range $r \approx 2.65 - 2.82$ $\mathrm{R}_\odot$. The field strengths for STEREO-A/COR1 and SOHO/LASCO-C2 are ≈ 0.32 G at $r \approx 3.11$ $\mathrm{R}_\odot$ and ≈ 0.12 G at $r \approx 4.40$ $\mathrm{R}_\odot$, respectively.

Combined Radio and Space-based Solar Observations: From Techniques to New Results
Guest Editors: Eduard Kontar and Alexander Nindos

This is an addendum to the article available at doi:10.1007/s11207-017-1180-6

✉ A. Kumari
anshu@iiap.res.in

✉ R. Ramesh
ramesh@iiap.res.in

✉ C. Kathiravan
kathir@iiap.res.in

✉ T.J. Wang
tongjiang.wang@nasa.gov

1 Indian Institute of Astrophysics, 2nd Block, Koramangala, Bangalore 560034, India

2 Department of Physics, The Catholic University of America and NASA Goddard Space Flight Center, Code 671, Greenbelt, MD 20771, USA

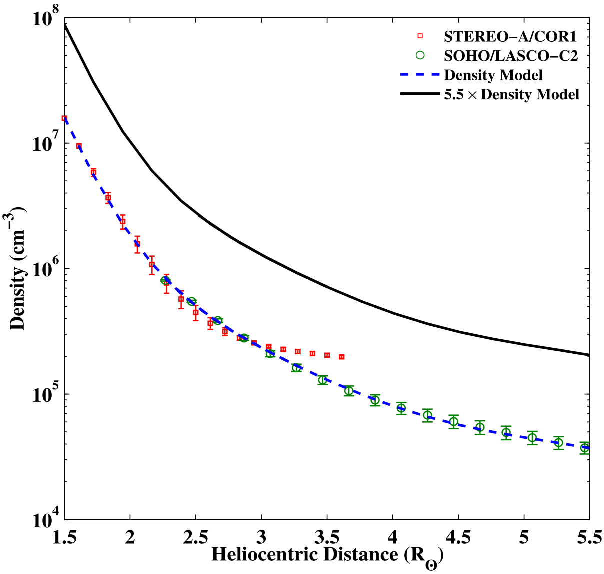

Figure 1 Estimates of $N(r)$ in the background corona using pB measurements with the STEREO-A/COR1 ($r \approx 1.5-3.7$ $R_\odot$) and the SOHO/LASCO-C2 ($r \approx 2.3-5.5$ $R_\odot$) coronagraphs. The *blue dashed line* ($r \approx 1.5-5.5$ $R_\odot$) is a fifth-order polynomial fit to the measurements of $N(r)$ with these two instruments. The *solid line* in the same distance range represents 5.5× the density values corresponding to the above fit. Note that this fit has excluded the COR1 data in the distance range $r \approx 3.0-3.7$ $R_\odot$ because of large uncertainty caused by instrumental noise (Wang *et al.*, 2017).

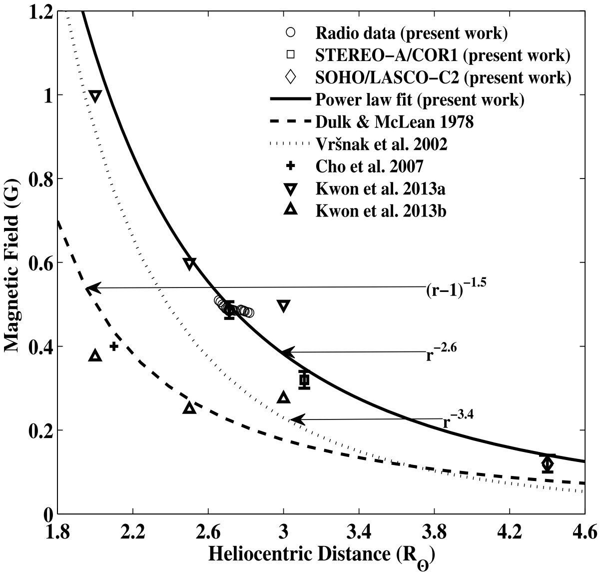

Figure 2 Estimates of $B(r)$ using band-splitting of the type II radio burst, and the shock standoff technique applied to the associated white-light CME observed with the STEREO-A/COR1 and SOHO/LASCO-C2 coronagraphs.

A single power-law fit, $B(r) = 6.7r^{-2.6}$ G, to the magnetic field is sufficient to describe $B(r)$ in the heliocentric distance range $\approx 2.5-4.5$ $R_\odot$ (see Figure 2). Note that power-law index of $B(r)$ obtained using Equation 1 is the same as the index reported in the article.

We have also included the error bars in the $N(r)$ measurements from the white-light images (see Figure 1). The error in the density estimates is mostly due to the instrumental background subtraction and to the spherically symmetric approximation (Wang *et al.*, 2017).

References

Wang, T., Reginald, N.L., Davila, J.M., St. Cyr, O.C., Thompson, W.T.: 2017, Variation in coronal activity from Solar Cycle 24 minimum to maximum using three-dimensional reconstructions of the coronal electron density from STEREO/COR1. *Solar Phys.* **292**, 97. DOI. ADS.