The Zeldovich Universe:
Genesis and Growth of the Cosmic Web
Proceedings IAU Symposium No. 308, 2014
R. van de Weygaert, S. Shandarin, E. Saar & J. Einasto, eds.

doi:10.1017/S1743921316010711

Faraday rotation in CMB maps

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Abstract. WMAP CMB polarization maps have been used to detect a low signal of Faraday Rotation (FR). If this detection is not interpreted as simple noise, it could be produced:

- at the last scattering surface (LSS) (z=1100), being primordial,
- at Reionization (z=10),
- in the Milky Way.

The second interpretation is favoured here. In this case magnetic fields at Reionization with peak values of the order of 10^{-8} G should produce this observational FR.

Keywords. cosmic microwave background, polarization, magnetic fields

1. Overview

A FR signal is detected by using foreground reduced maps of Stokes Q and U parameters provided by WMAP9 (Hinshaw *et al.* (2013)) at frequencies 33, 41 and 61 GHz.

The magnetic field strength at Reionization is obtained taking into account the value of the optical depth at this epoch derived by WMAP9 (i.e. ~ 0.089) (Hinshaw *et al.* (2013)).

Figure 1 shows the observational magnetic field distribution at Reionization from foreground reduced maps at 33, 41 and 61 GHz for a pixel size of 3.6 deg. This plot assumes that FR is produced at this epoch.

Figure 2 shows the angular power spectrum of this observational magnetic field distribution.

In Table 1 it is shown the correlation coefficient of our observational distribution of magnetic field (see Fig.1) and different maps that characterized Recombination and Galactic FR.

The polarized temperatures at Recombination are much lower than the Milky Way intensities but Rotation Measures are higher. This LSS interpretation would require

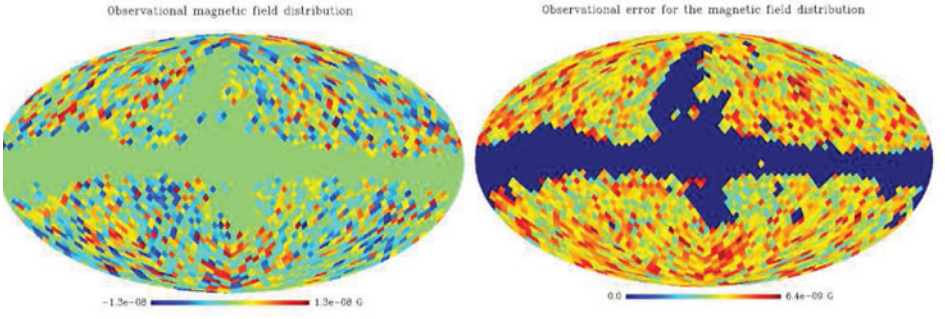

Figure 1. Magnetic field distribution and its corresponding error map.

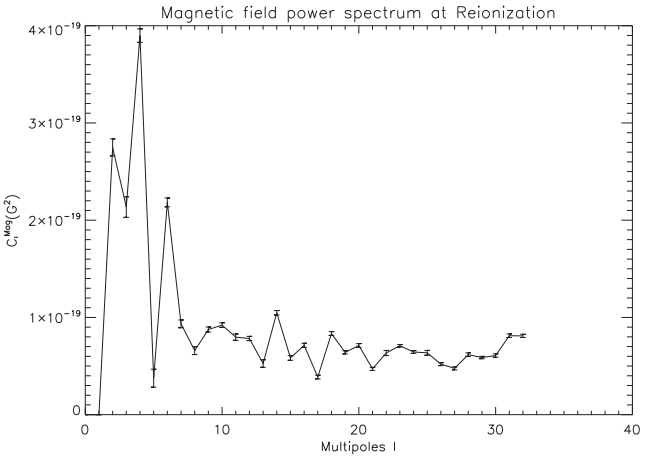

Figure 2. Power spectrum of the magnetic field distribution.

Table 1. Correlation coefficients.

Maps	**Correlation coefficient r**
CMB temperature	0.054 ± 0.015
Galactic RM (1.4-23 GHz)	-0.014 ± 0.034
Galactic RM (Extragalactic radio sources)	0.068 ± 0.015
Stokes U (23 GHz)	0.048 ± 0.015
Stokes Q (23 GHz)	0.002 ± 0.015
Stokes U (galactic dust)	-0.004 ± 0.015
Stokes Q (galactic dust)	-0.008 ± 0.015
Rotated angle (galactic dust)	-0.018 ± 0.015

magnetic field strengths higher than the limits found by Planck of 3.4 $\times 10^{-9}$ G (Planck Collaboration 2013).

Also, the correlation coefficient with the primordial temperature is very low, as shown in the table.

The correlation coefficients for typical galactic intensities are also very low, which probably indicates that the separation of the galactic component was satisfactorely made.

The multipole range of our spectrum is typical of phenomena taking place at Reionization. Therefore the data are consistent with magnetic fields at Reionization of the order of 1-10 nG.

Acknowledgements

This work was partially supported by projects CSD2010-00064 and AYA2011-24728 of the Spanish Ministry of Economy and Competitiveness (MINECO) and by Junta de Andalucía Grant FQM-108.

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https://doi.org/10.1017/S1743921316010711 Published online by Cambridge University Press