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Mapping the diffuse magnetised gas in the Shapley Supercluster

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Abstract

The bridge between the two most massive clusters in the Shapley Supercluster (A3558-A3562) is a perfect candidate to find 'missing baryons', and they reveal themselves through the combined signal from Faraday Rotation and the Sunyaev-Zeldovich (SZ) effect. Using a rotation measure (RM) grid from ASKAP and Planck's y-Compton parameter SZ map of the Shapley Supercluster we are able to break the degeneracy between the product of density of free electrons and the magnetic field along the line of sight ($n_e B_\parallel$) that is present in the definition of the RM. In order to get a signal from the magnetic field, we compare the scatter in the RM in different samples, based on their strength in the y-map. The higher the difference in the scatter between these two samples, the stronger the signal. The average magnetic field strength is then computed using a single-scale (l_B) model for the magnetic field distribution in the clusters and the region between them, and assuming constant temperature and density of electrons. We also have to estimate the path length L that photons travel through the system. By combining, for the first time, an RM grid and the SZ effect, we were able to estimate the average magnetic field along the line of sight in the whole system to be $B_\parallel \approx 1\,\mu\mathrm{G}\,\left(\frac{n_e[\mathrm{cm}^{-3}]}{10^{-4}}\right)^{-1}\left(\frac{L[\mathrm{Mpc}]}{3}\frac{l_B[\mathrm{kpc}]}{50}\right)^{-1/2}$.

My poster in zenodo.org can be found here