

Probing primordial magnetic fields with cosmic microwave background and 21 cm line observations

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Observations show magnetic fields to be associated with a great number of objects and on very different scales in the universe, from stars, to galaxies, clusters of galaxies and even beyond.

It is an open question if there exists a magnetic field on cosmological scales which pervades the whole universe. One possible origin could be in the very early universe.

Because of contributions to the cosmological perturbations as well as magnetic field dissipation primordial magnetic fields directly influence, for example, the temperature anisotropies and polarization of the cosmic microwave background (CMB) as well as large scale structure.

New possibilities to constrain primordial magnetic fields arise with current and upcoming observations of the 21 cm line of neutral hydrogen such as with the Square Kilometre Array Observatory (SKAO).

Using 21 cm intensity maps as well as cross correlations of the CMB Doppler mode and the 21 cm signal prospects of constraining primordial cosmic magnetic fields are considered for LOFAR and SKAO for homogeneous and inhomogeneous reionization. In particular the latter in combination with SKA1-mid shows promising signal-over-noise ratios.

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