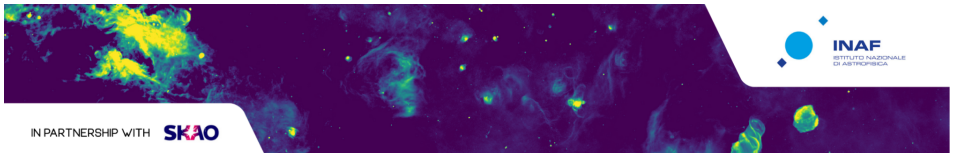

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Probing the post-reionization HI distribution using the redshifted 21-cm marked power spectrum

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Observations of the neutral hydrogen (HI) 21-cm signal have the potential to map out the large-scale structures (LSS) of our Universe during the post-reionization era (z ⊠ 6). Several present and future experiments are planned to give their efforts to probe the signatures of the LSS inherent in the expected signal over a large redshift range. A correct prediction of the expected signal demands a detailed modeling of the HI distribution, and more so for a correct interpretation of the signal once detected. In this work, we have carried out semi-numerical simulations to model the HI distribution and study its power spectrum and marked power spectrum during post-reionization. The so-called marked power spectrum studied in this work is a way to use power spectra that give more weight to low and intermediate HI densities and show a clear time evolution of the HI distribution. On the contrary, the standard power spectrum, which is only affected by the high-density regions, shows a weaker time evolution of the HI distribution when compared to the evolution of the dark matter distribution. However, a crucial assumption that the HI distribution on a large scale follows the underlying dark matter distribution, suggests the HI distribution evolves significantly during the post-reionization. In this work for the first time, we show that the marked power spectrum can provide a better insight into the HI distribution and its time evolution together with its environment and, thus, might be able to put a better constraint on the astrophysical and cosmological parameters.

Topics

Cosmology

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