

HI intensity mapping with MeerKAT: Hunting down the power spectrum

Abstract

The HI intensity mapping technique promises to provide game-changing measurements for Cosmology by observing the large-scale structure of the Universe over vast cosmic volumes and a wide range of redshifts. It is a key survey mode for the SKA that will allow it to probe baryon acoustic oscillations, redshift space distortions and cosmology on ultra-large scales using the auto-correlations from the telescope. Before the start of SKA operations, however, a large sky survey with the recently built MeerKAT can provide the first ever measurements of the baryon acoustic oscillations and redshift space distortions using the 21cm intensity mapping technique, with enough accuracy to impose constraints on the nature of dark energy and modified gravity. Building on the results of previously successful tests, we propose a pilot survey capable of achieving the required sensitivity of the large MeerKAT cosmology survey but on a smaller patch of the sky. The main goal is to make the first ever detection of the 21cm power spectrum and measure the cosmological HI mass density up to redshift $z \sim 0.5$, using MeerKAT single dish observations. We will take full advantage of cross-correlation between different dishes and overlapping galaxy surveys in order to reduce systematics. The high signal to noise achieved in each pixel will allow us to test for any contamination that may affect the larger survey, providing crucial insights towards our goal of probing cosmology with MeerKAT and the future SKA.