1. Can we make an HI detection with existing high-z TDA data ?

Peter Timbie

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Sourabh Paul will give a presentation at the PUMA call on Tuesday Feb 14, 12 N Eastern

A first detection of neutral hydrogen intensity mapping on Mpc scales at $z \approx 0.32$ and $z \approx 0.44$

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ABSTRACT

We report the first direct detection of the cosmological power spectrum using the intensity signal from 21-cm emission of neutral hydrogen (HI), derived from interferometric observations with the L-band receivers of the new MeerKAT radio telescope. Intensity mapping is a promising technique to map the three-dimensional matter distribution of the Universe at radio frequencies and probe the underlying Cosmology. So far, detections have only been achieved through cross-correlations with galaxy surveys. Here we present independent measurements of the HI power spectrum at redshifts 0.32 and 0.44 with high statistical significance using a foreground avoidance method (at 8.0σ and 11.5σ respectively). We constrain the rms of the fluctuations of the HI distribution to be $\sigma_{\rm HI} = (0.44 \pm 0.04)$ mK and $\sigma_{\rm HI} = (0.63 \pm 0.03)$ mK respectively at scales of 1.0 Mpc. The information contained in the power spectrum measurements allows us to probe the parameters of the HI mass function and HI halo model. These results are a significant step towards precision cosmology with HI intensity mapping using the new generation of radio telescopes.

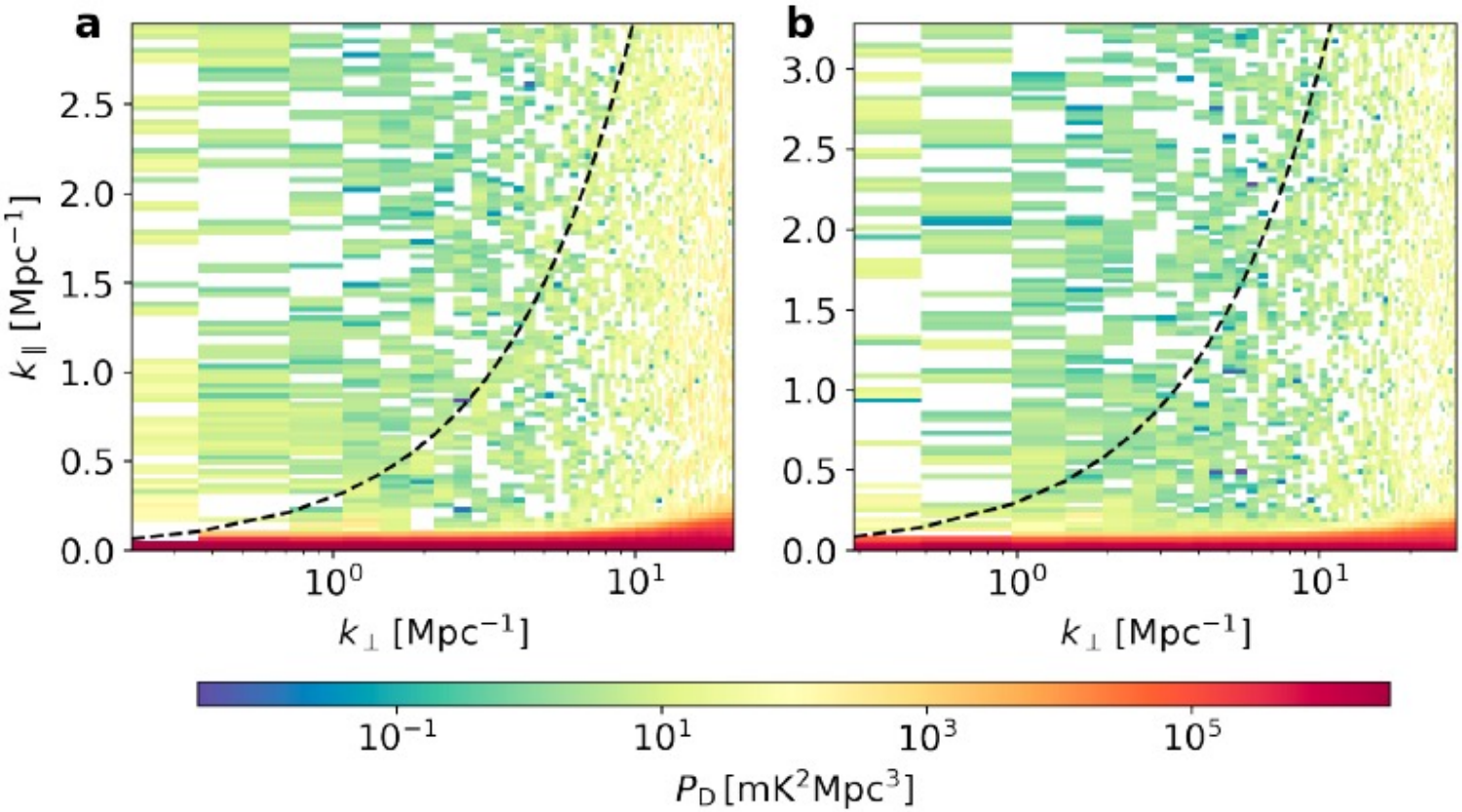

Figure 2. 2-d power spectrum from the analysis of 96-hrs MeerKAT interferometer data at z = 0.32 and z = 0.44. **a,** with Stokes I visibility data, cross-correlating the even and odd scan cubes for $z = 0.32$. **b,** for $z = 0.44$. Negative values are left blank. The $(k_\perp, k_\parallel)$ modes above the black dashed line ($k_\parallel > 0.3k_\perp$) are used to calculate the 1-d power spectrum.

3. Simulations of stacking analysis with simulated maps from Perdereau et al. ‘22

2. Observations with TDA tuned to low-z?

4. WIYN/Hydra survey paper