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Hydrogen Intensity Mapping: The ultimate signal is the weakest of all

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Probing the Universe's large-scale structure (LSS) leads to a wealth of cosmological information. With the advent of unprecedentedly giant radio telescopes, we can start using the neutral hydrogen (HI) 21-cm emission to trace the LSS. In particular, a novel observational strategy is catching on: Intensity Mapping (IM). With IM, we relax the requirement of source detection and go after all the integrated 21-cm emissions: we can produce detailed three-dimensional maps of a good fraction of the observable Universe. On the one hand, this strategy carries a potentially revolutionary science output. But, on the other, these observations have been extremely challenging to perform. In particular, disentangling the HI IM signal from orders-of-magnitude more intense and intricate contaminants is the thorniest problem. In this talk, I will discuss how we address this challenge with first-of-their-kind observational data from the MeerKAT radio telescope, a precursor to the SKA Observatory (SKAO). Our ongoing work demonstrates that a radio array operating as a collection of independent telescopes can probe the IM cosmological signal, marking a milestone for the cosmology science case with the entire SKAO.

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