

An Engineering prototype for the DARE (Dark Ages Radio Explorer)

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The Dark Ages Radio Explorer (DARE) is designed to measure the all sky-averaged HI 21-cm signal from the Dark Ages and Epoch of Reionization. DARE will orbit the Moon for a mission lifetime of ≤ 3 years and only take data above the lunar far side. DARE comprises of a single radiometer operating between 40-120 MHz (redshifts $z=11-35$). The science objectives of DARE include formation of first stars, first accreting black holes, beginning of reionization and end of the Dark Ages. The science instrument is composed of a three-element radiometer, including electrically-short, tapered, bi-conical dipole antennas, a receiver, and a digital spectrometer.

Although the TRL (Technology Readiness Level) of the individual components of DARE instrument is high, the overall instrument TRL is low. One of the main aim of the entire DARE team is to advance the instrument TRL. An engineering prototype is currently deployed near the future SKA-low site in Western Australia for an end-to-end validation of the instrument and our calibration techniques. The observations with the DARE prototype are essential to characterize the effect of RFI (Radio Frequency Interference) and the Ionosphere at these low frequencies near the future SKA-low site. The effects of Ionosphere and RFI are also the two major challenges for a ground based DARE-like experiment. This talk will focus on the DARE mission concept and latest results from the observations with the DARE prototype. This talk will also outline a new calibration technique based on single-load approach as compared to a dual-load approach implemented in other DARE-like experiments from the ground. The single-load approach is based on detailed circuit modeling of DARE instrument accompanied with very high precision laboratory measurements of the instrument carried out in NRAO, JPL and ASU.

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