
Impact of calibration sky models on EoR angular power spectrum

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Description:

The Murchison Widefield Array (MWA) is a radio telescope, located at the Murchison Radio-astronomy Observatory in the mid-west of Western Australia which is considered ideal for its low-level radio frequency interference. The instrument serves as a precursor for Low-Frequency Square Kilometer Array. The first construction phase of the MWA, commonly known as Phase I, consists of 128 tiles. Each tile is made up of 4x4 dual polarized dipoles. These tiles are optimized to operate between 70-300 MHz. Phase I of the MWA was among the first-generation radio interferometers focused on the detection of the Epoch of Reionization (EoR) and it was designed as a general-purpose array to improve both the imaging capabilities and sensitivity on angular power spectrum scales. The EoR is the period when the Universe went from being completely neutral to an ionized one. Phase II of the MWA was designed through lessons learnt from MWA Phase I and other experiments dedicated toward the EoR, which is an update of 56 new tiles beyond the circumference of the existing ones.



Figure 1: MWA Tiles (Tingay et al. 2012)

Observations of the EoR using the 21 hydrogen lines are challenged by strong Galactic and extra-Galactic foregrounds that are a few orders of magnitude higher than the desired 21 cm signal. Precise calibration is one of fundamental keys to separation of these bright foregrounds from the desired 21 cm signal. MWA uses a Real Time and Imaging System (RTS) for data reduction and calibration. An improved version of the RTS is currently being developed by the MWA Team, known as Hyperdrive^[1]. The objectives of the project are:

- To calibrate Phase1/Phase II data using hyperdrive and compare with RTS
 - To estimate a lower bound for point sources in our calibration models beyond which negligible difference is observed in the EoR angular power spectrum
 - To derive (if any) a relationship between array layout and flux density threshold in our sky models.
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- To estimate any instrumental leakage in the EoR power spectrum caused by using incomplete sky models for calibration.

[1] https://github.com/MWATelescope/mwa_hyperdrive
