Abstract Submitted
for the 4CF15 Meeting of
The American Physical Society

Instrumental Effects on 1-Point Statistics in Redshifted 21 cm Observations PIYANAT KITTIWISIT, JUDD BOWMAN, DANIEL JACOBS, NITHYANANDAN THYAGARAJAN, ADAM BEARDSLEY, School of Earth and Space Exploration, Arizona State University — We study the impact of instrumental systematics on the 1-point statistics of redshifted 21-cm signal from reionization via data-driven simulations. We simulate realistic 21-cm observations based on the Murchison Widefield Array (MWA) reionization experiment, incorporating full-sky semi-analytic 21-cm models, phased-array antenna beam response, and an existing MWA imaging pipeline. The simulations produce 2-second driftscan snapshots of 21-cm intensity maps, spanning across redshift 6 to 9, as seen by the MWA. Previous studies suggest that the pixel probability density function (PDF) and higher-order statistics in the theoretical 21-cm maps should exhibit non-Gaussian features. Our results show that the instrumental beam response strongly corrupts these features. The shortest antenna pairs in the array that sample one-degree scales influence the shape of the PDF the most by smoothing out non-Gaussian features in the smaller scales. Sidelobe confusion further masks out non-Gaussian features by adding noise-like structures to the maps. Nevertheless, the features can still be seen as a positive skewness toward the end of reionization when the theoretical 21-cm PDF becomes highly bi-modal.

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Date submitted: 10 Sep 2015 Electronic form version 1.4