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The Dawn of 21cm Cosmology with EDGES

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After stars form in the early Universe, their ultra-violet light alters the excitation state of the 21cm hyperfine line of neutral hydrogen gas in the intergalactic medium. This initially causes the gas to absorb photons from the cosmic microwave background (CMB). Later, energy deposited into the gas by the ultra-violet and X-ray emission from these early stars and their remnants heats the gas and eventually ionizes it. These effects produce spectral features in the CMB observable today at frequencies below 200 MHz.

The Experiment to Detect the Global EoR Signature (EDGES) measures the all-sky radio spectrum between 50 and 200 MHz from the Western Australian outback. The experiment consists of several instruments. In 2015-2016, a high-band instrument was been operated covering 90-200 MHz (14>z>6). Since 2016, a low-band instrument has been operated covering 50-100 MHz (27>z>13) with a duplicate instrument entering operation in 2017. In November 2017, a mid-band instrument replaced the first low-band instrument and covers 60-180 MHz.

Each EDGES instrument utilizes a nearly identical receiver and scaled copies of the same antenna design. The low-band ground plane is larger than for the high-band and extends out to 15 meters from the antenna, compared to 7 meters for the high-band ground plane. Each receiver includes two internal noise references for stability calibration. Extensive laboratory calibration measurements are acquired before deploying each instrument in order to achieve absolute calibration at the 0.01% level.

Analysis of data from these instruments is ongoing with several results recently released, including new constraints on the duration of the reionization epoch that disfavor fast reionization scenarios less than dz~1. We are presently exploring constraints on astrophysical model parameters using models from Greig & Mesinger, Mirocha, and Fialkov, Barkana & Cohen. In low-band and mid-band observations, we find persistent residuals to polynomial foreground model fits removed from the data. Consistent results are obtained for all LST bins, both low-band and the mid-band instrument, and two analysis pipelines. We will report the latest updates from these efforts.