Global 21-cm-line Measurements with the EDGES Telescope

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As one of the instruments at the forefront of cosmological 21-cm-line studies, the Experiment to Detect the Global EoR Signature (EDGES) continues its observations from the Murchison Radio-astronomy Observatory, approximately 370 Km from Geraldton, Western Australia. It operates in the range 100 - 200 MHz aiming to detect the Hydrogen-line signal emitted during the Epoch of Reionization (EoR) at redshifts $6 < z < 15$, when the intergalactic gas was transitioning from a neutral to a completely ionized state following the Dark Age of the Universe.

Theoretical models indicate that the EoR signal is expected at temperature levels of approximately 30 mK, which poses a tremendous challenge for detection when considering limitations such as instrumental calibration uncertainties, strong natural foregrounds, and artificial interference, in the context of a cosmological signal with large fractional bandwidth. Due to this strict scientific requirement, EDGES incorporates several novel elements along its instrumental chain.

As an experiment aiming for the global (spatially averaged) EoR signal, EDGES revolves around a single-antenna design. A Fourpoint antenna has been chosen due to its natural broadband characteristics and the low dependence of beam properties on frequency. A Roberts balun integrated to the antenna itself is responsible for interfacing between the balanced output of the antenna and the unbalanced amplification stage. The advantages of this model over traditional baluns include low loss, and extra flexibility for fine-tuning the impedance presented to the system by the antenna-balun combination. Pre-established temperature-dependent models of the antenna reflection coefficient are used during the offline science analysis in order to account for variations of this quantity due to diurnal temperature cycles. Temperature control has been added to the low noise amplification stage in order to stabilize the performance of its impedance-match and gain. Finally, an infrared reflectance coating has been applied to the antenna and low-noise amplifier in order to further minimize temperature-related systematic effects.

This talk will provide an update of the EDGES telescope with focus on the upgrade it underwent during November 2013. Preliminary science data will be presented and discussed, as well as possible improvements envisioned for future instrumental upgrades.