

Fingerprints of the First Stars in the Sky-Averaged Radio Spectrum

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The period of the Universe known as Cosmic Dawn is marked by the formation of the first stars, before 100 million years after the Big Bang. These stars formed due to the gravitational collapse of primordial neutral hydrogen gas left over after the release of the cosmic microwave background (CMB). The ultraviolet radiation that these stars emitted penetrated the atoms of the surrounding neutral hydrogen gas, which caused the gas to absorb photons from the CMB. This alteration of the hydrogen gas should be observable today as an absorption feature in the radio spectrum at frequencies below 200 MHz. In this talk I will describe the detection by the EDGES experiment of an absorption feature in the sky-averaged spectrum centered at 78 MHz. This feature implies absorption of the microwave background by the hydrogen gas approximately 180 million years after the Big Bang, which is broadly consistent with predictions. However, the amplitude of the observed signal is ~ 0.5 K, twice as large as expected. New theories have already been proposed that try to explain this deeper absorption. Two leading options correspond to a higher radiation background than previously thought during Cosmic Dawn, and a new form of interaction between the hydrogen gas with the colder dark matter. I will review the theory of this cosmological radio measurement and describe the EDGES experiment, including the instruments used for the detection and the data analysis.

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