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## Detecting the first stars and black holes with 21-cm cosmology

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A major frontier area in cosmology is cosmic reionization, the key epoch in which the intergalactic hydrogen throughout the universe was reionized after having recombined in the early universe. Despite uncertainties about the sources of radiation at early times, it is widely assumed that prior to reionization the cosmic gas must have been pre-heated to well over the temperature of the cosmic microwave background. We show instead that the universe is likely to heat significantly only during reionization. This dramatically changes the expectations for currently operating as well as planned radio telescope arrays aimed at detecting the 21-cm spectral line of atomic hydrogen at high redshift. Observing the resulting signatures would provide a remarkable probe of some of the earliest stars (likely responsible for reionization) and black holes (responsible for the heating).

**Primary author:** Prof. BARKANA, Rennan (Tel Aviv University)

**Presenter:** Prof. BARKANA, Rennan (Tel Aviv University)

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