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Constraining First Star Formation with 21cm-Cosmology (Anna Schauer)

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Within standard ΛCDM cosmology, Population III (Pop III) star formation in minihalos of mass $M_{\rm halo} > 5 \times 10^5$ M$_\odot$ provides the first stellar sources of Lymanα (Lyα) photons. The Experiment to Detect the Global Epoch of Reionization Signature (EDGES) has measured a strong absorption signal of the redshifted 21 cm radiation from neutral hydrogen at $z \approx 17$, requiring efficient formation of massive stars before then.

In this talk, I will first review the important role that baryon-dark matter streaming velocities play in the context of Pop III star formation. I will then show our model which investigates whether star formation in minihalos plays a significant role in establishing the early Lyα background required to produce the EDGES absorption feature. We indeed find that Pop III stars are important in providing the necessary Lyα-flux at high redshifts, and derive a best-fitting average Pop III stellar mass of $\sim$ 750M$_\odot$ per minihalo, corresponding to a star formation efficiency of 0.1%. Streaming velocities do play an important role in the calculation, to limit the efficiency of Pop~III star formation in minihalos. Without this effect, the cosmic dawn coupling between 21 cm spin temperature and that of the gas would occur at redshifts higher than what is implied by EDGES.

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