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Multi-tracer forward-modeling of the first billion years

The 21cm signal promises to revolutionize our understanding of the first cosmic structures, eventually allowing us to map out the entire observable Universe. However, we have yet to obtain a detection of the interferometric radio signal from this Cosmic Dawn of structure. In these early days, it will be of utmost importance to synergize preliminary 21cm observations with more established probes in order to learn complimentary physics as well as confirm initial claims of a detection. I will introduce 21cmFASTv4, a new version of the public simulation package for interpreting multi-tracer observations of the first billion years. 21cmFASTv4 features a new, efficient halo finder as well as a flexible semi-empirical framework to connect galaxies to host halos. Built with field-level Bayesian inference in mind, it allows for self-consistent forward models of multiple tracer fields (e.g. 21cm, galaxies, CMB anisotropies, line intensity maps), as well as the inclusion of residual systematics during post-processing. I show some examples of this approach, including interpreting recent results from the HERA telescope, high- z galaxy observations from JWST, as well as field-level inference from galaxy and 21cm maps.

Topics

Epoch of Reionization and Cosmic Dawn

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