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Bayesian Insights into the high-redshift Universe with 21cmPIE-cINN

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Utilizing 21cm tomography provides a unique opportunity to directly investigate the astrophysical and fundamental aspects of early stages of our Universe's history, spanning the Epoch of Reionization (EoR) and Cosmic Dawn (CD). Due to the non-Gaussian nature of signals that trace this period of the Universe, methods based on summary statistics omit important information about the underlying physics. Here we demonstrate that likelihood-free inference with a BayesFlow setup consisting of a 3D CNN and a small cINN can give us the full posterior in a consistent and fast way. The chosen parameter set reflects a warm dark matter universe, where the cosmological parameters strongly influence the CD and EoR parameters.

Authors: SCHOSSER, Benedikt (Heidelberg University); HENEKA, Caroline; HEIMEL, Theo (Heidelberg University); PLEHN, Tilman

Presenters: SCHOSSER, Benedikt (Heidelberg University); HEIMEL, Theo (Heidelberg University)

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