
Infering astrophysical knowledge from Cosmic Dawn observation with numerical simulations.

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Résumé

Observations to detect and characterize the 21-cm signal from the Cosmic Dawn and the Epoch of reionization are ongoing on a number of radio-interferometers, including NenuFAR at Nancay. They will culminate with a Key Science Program on the SKA.

To extract information about the underlying astrophysical processes (such as the nature and formation history of the first sources of light), one needs a robust forward model and a reliable inference framework. The complex, non-linear physics at play, including gravitation, hydrodynamics and radiative transfer at several wavelength, make numerical simulations a natural avenue for modelling the signal. They are however typically costly and not suitable in a classical Bayesian Inference framework. Modern statistical approaches, most often making use of Machine Learning, must be leveraged.

I will present the ongoing efforts of our team to 1) adapt the state-of-the-art LICORICE code to this challenge 2) build a large set of simulations spanning the parameter space to act as a learning sample 3) employ various machine learning methods as an inference framework.

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