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Type : **Poster**

The Long and Winding Equation: Symbolic Regression for Power Spectra from the Cosmic Dawn and Epoch of Reionization

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The formation of first-generation stars and galaxies marks the onset of Cosmic Dawn. The Epoch of Reionization ensues when these structures emit ultraviolet light that ionizes neutral hydrogen in the universe. Although these epochs are some of the least understood, the 21 cm signal, which is emitted from the spin flip transition of neutral hydrogen's ground state, is a promising probe for them. The power spectrum, defined as the Fourier transform of the two-point correlation, measures the amplitude of this signal and can be directly obtained by radio telescopes. In this work, we aim to identify how various physical parameters influence this power spectrum by finding an interpretable, compact equation that describes it. We use AMBER, a semi-numerical code, to simulate neutral and ionized hydrogen maps between redshifts 5 and 15. We vary the physical parameters in this code and generate power spectra for each parameter set in the stated redshift range. We then apply symbolic regression, a machine-learning algorithm that computes a best-fit equation to given data. We use the PySR library that implements this algorithm and obtain the power spectrum as a function of physical parameters. Our current best-fit equations contain redshift, spatial frequency, and most physical parameters as arguments. The mean squared error of these equations is found to be of the order of 0.01 compared to AMBER's results. This work shows an independent way of understanding how various physical effects shape the power spectrum throughout Cosmic Dawn and reionization.

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No

If you are selected for a poster, would you be interested in giving a short flash talk on your work?

Yes

What is your career level?

Undergraduate

Which keyword describes the area of focus of this talk?

Cosmology

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