Accelerating the modeling of HI on cosmological scales via Deep Learning

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Abstract

Hydrodynamical simulations offer a promising framework to study the formation and distribution of atomic hydrogen in the Universe but they often pose significant computational obstacles. We present a new method based on Deep Convolutional Neural Networks to efficiently predict atomic hydrogen maps from dark matter fields. After being trained on a combination of zoom-in simulations and small cosmological boxes, this approach is able to reproduce the gas and HI power spectra in the simulations over a broad range in scales down to galaxy scales (_˜10 kpc) with a _˜10% accuracy and at neglible computational cost. This methodology is subsequently applied to predict high-resolution HI maps for larger cosmological volumes based on dark-matter-only simulations. Applications, advantages, and drawbacks of this approach are briefly discussed.
Poster: in PDF
Video: https://youtu.be/wDK9ZWHU4nE

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