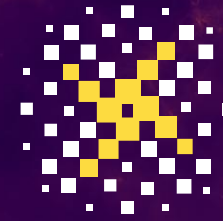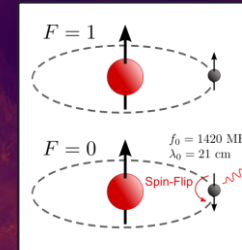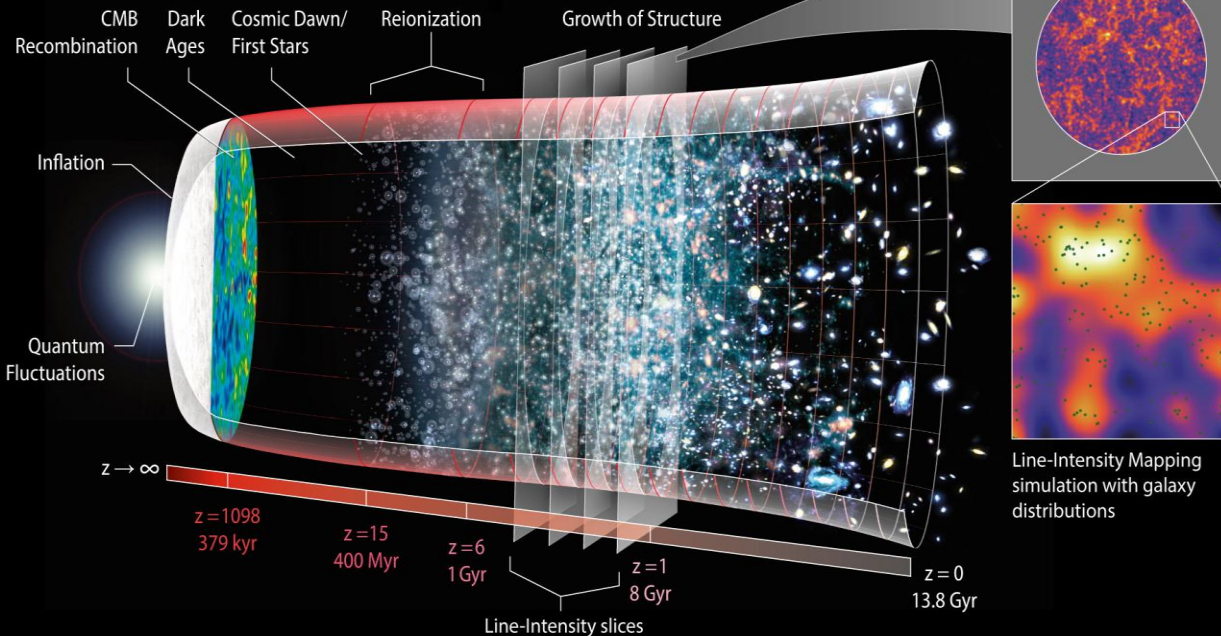# ACCURATE AND COMPUTATIONALLY INEXPENSIVE 21 CM MAPS WITH DIFFUSION MODELS

Satvik Mishra

SISSA **DATA**SCIENCE
Machine Learning for the Natural Sciences

Line Intensity Mapping (LIM)

Line-Intensity Mapping simulation with galaxy distributions

https://lambda.gsfc.nasa.gov/education/graphic_history/intensitymapping.html

MOTIVATION

Neutral hydrogen traces the distribution of dark matter and cold gas across cosmic time, enables cosmological tomography.

IDEA AND PIPELINE
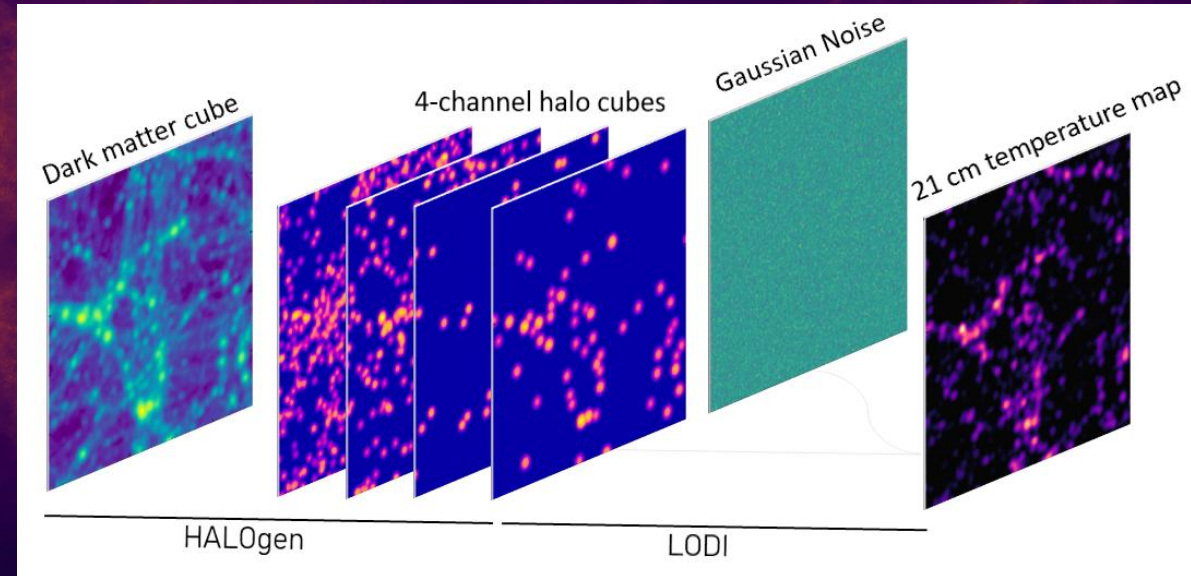
Predicting 21 cm signals accurately requires **computationally expensive hydrodynamic simulations.**
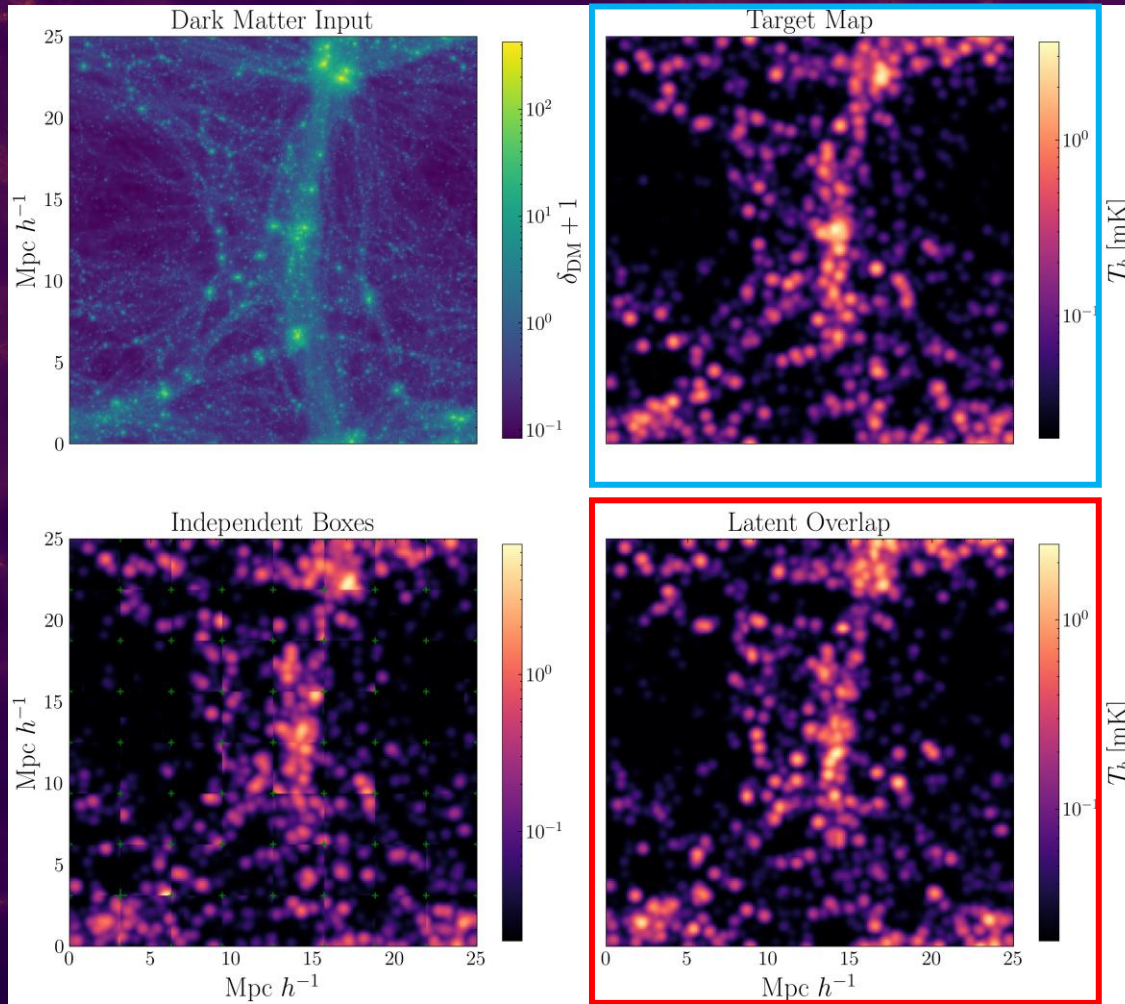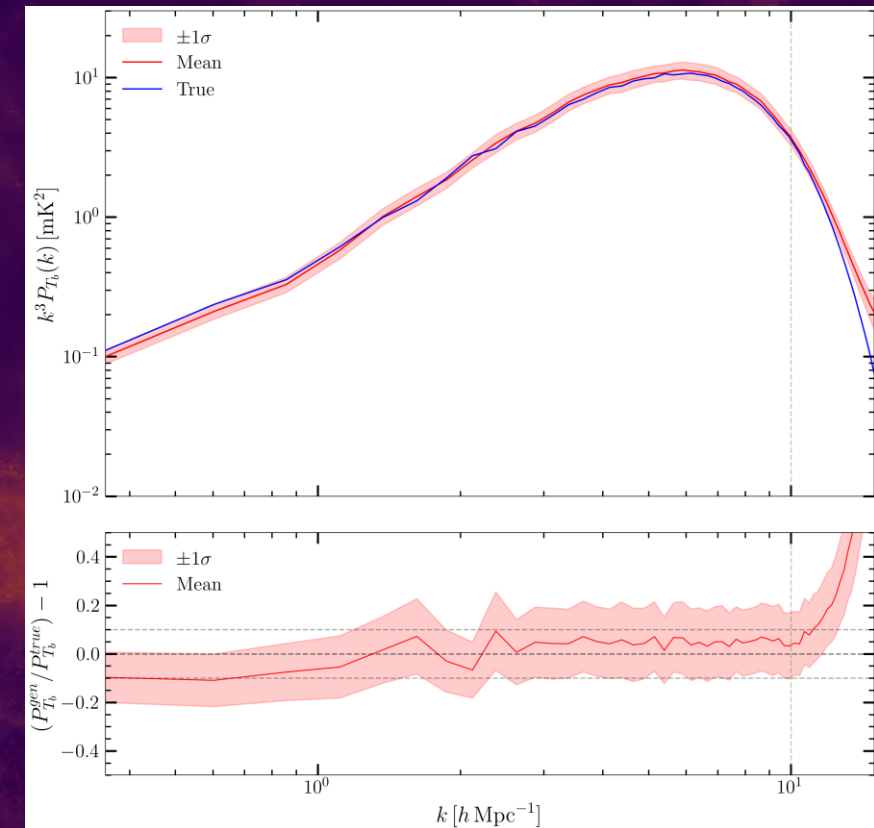
IllustrisTNG

256^3 Gas particles

6000 CPU hours
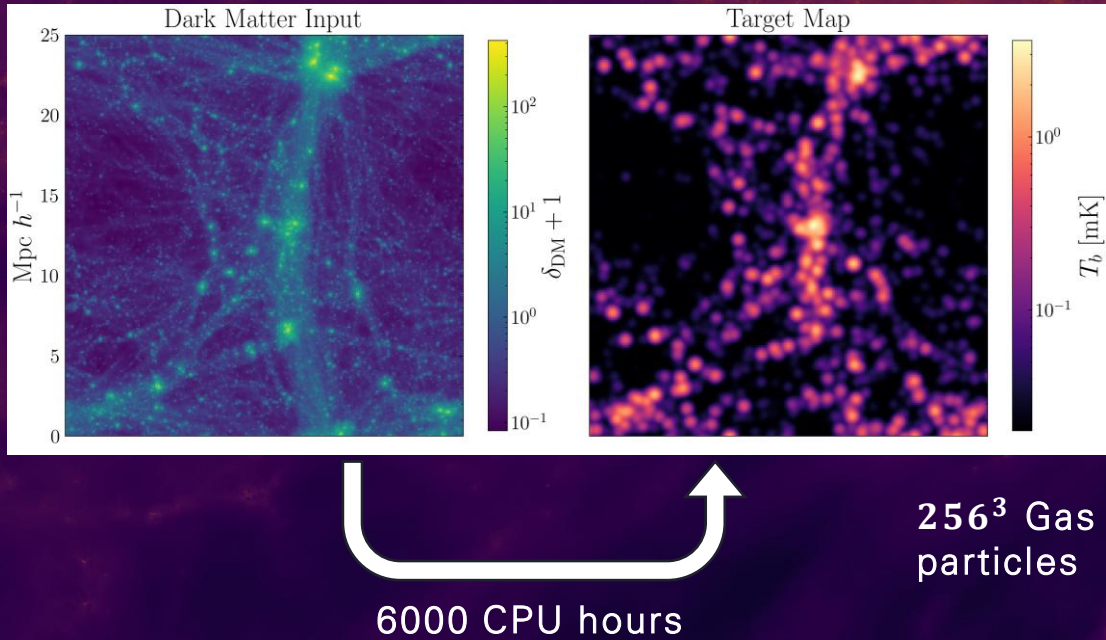
Pipeline (3D)

~ **100** sec on 1 GPU

DOES IT WORK?

Simulated

Generated

Accuracy of $\leq 10\%$ upto nonlinear regimes of $k = 10h \ Mpc^{-1}$

For more details, come see the poster!