LEARNING THE UNIVERSE:
Using GRSPINN to predict Large Scale Structure

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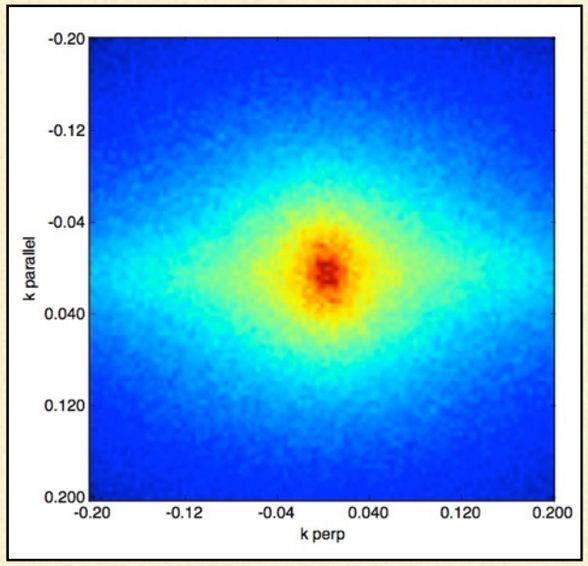
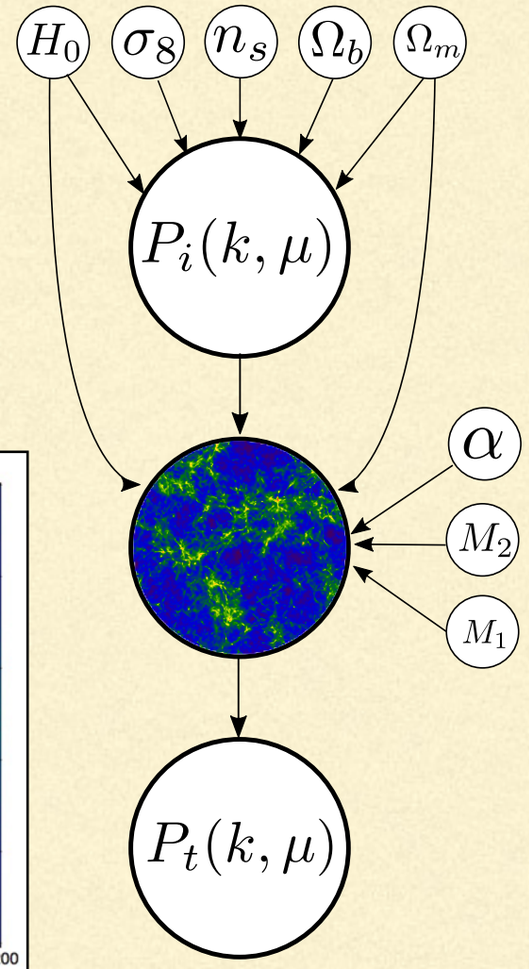
REDSHIFT SPACE POWER SPECTRA

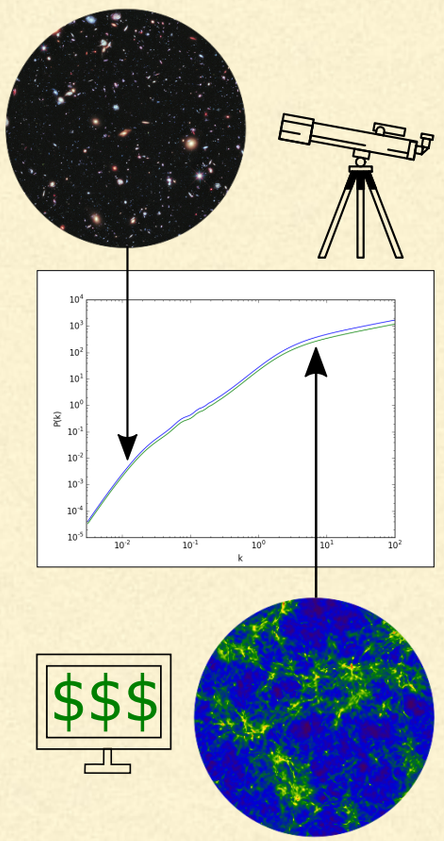
- Each power spectrum requires a computationally expensive N-body simulation to predict (≈CPU days)

- Posterior over parameters is inferred through MCMC by comparing model predictions to observations O(10^4 model runs)

- Problem: parameter space is high dimensional, MCMC with N-body simulations is too expensive



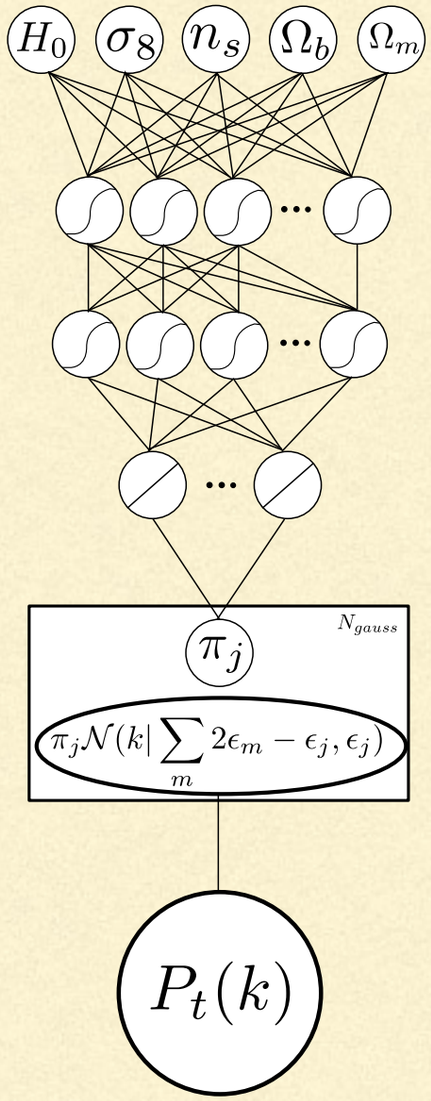


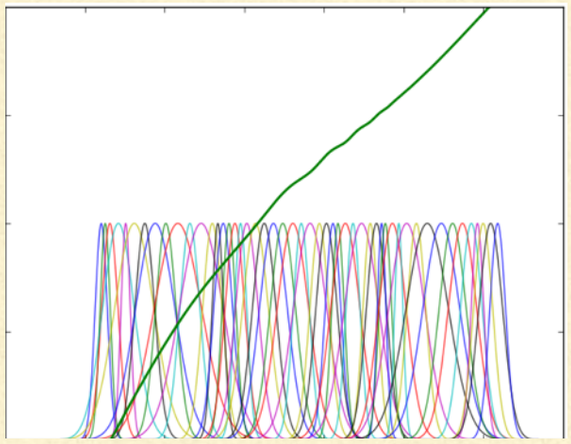


GRSPINN:

Galactic Redshift Space Power spectrum Interpolation using Neural Networks

- Power spectra adjacent in parameter space will be similar, it is a smoothly varying function
- Neural networks offer an exceptionally flexible, low memory and fast (≈μCPUseconds) method of interpolation, which have been used on similar problems (Agarwal et al. 2012)
- We use a Legendre decomposition to generalise to 2-dimensions
- Our architecture learns redshift space power spectrum predictions for any k,μ and any cosmology within our parameter range





$$P(k,\mu) = P_0(k)L_0(\mu) + P_2(k)L_2(\mu)$$

RESULTS

- On a test 1-dimensional dataset, only 200 simulations required for training

- sub-% accuracy across entire k-range for an unseen test set

- accurate MCMC in CPU minutes instead of CPU years