**Week 1:**

Meeting 17/01

* Met Ben and Arkistis.
* Described by background in programming and theory.
* Power spectrum: (dark) matter distribution of the universe
* BNN bit more detail.
* Testing/Developing on Colab… final training on colab
* Play around (install at least) with BaCoN for next week, read paper and cosmology notes.

Work during the week:

* Wrapped my head around file management with github, colab and vscode.
* Read the power spectra chapter of cosmology notes. Very beyond my level but I think I have some sort of grasp. Will try explaining what I’ve understood in meeting with Ben and Alkistis.
* Read the readme in the BaCoN Repo.

**Week 2 (Understanding what’s going on)**

For meeting on 26/1

* Will try explaining what I’ve understood about power spectra:
  + Dark matter needed to explain observations like galactic rotation curves, dark energy needed to explain additional energy density that results in the flat universe we have observed.
  + The data are the fourier wavenumbers of the density contrast, explain redshift bins 🡪 redshift bins quantify the distance (thus age) at which we are measuring / calculating the power spectrum. How does this tie into the maths?
  + Density contrast describes the (fractional?) oscillation of energyy density within a comoving volume.
  + Why does energy density reveal about both dark energy and dark matter?
  + Understand idea of comoving volume a bit better.
  + Fourier components with wavenumbers k thus describe oscillations at length scales 2pi/k?
  + Power spectrum w.r.t k is thus the average of the squared modulus components across all directions for a magnitude k.
  + New physics 🡪 not lambda cdm
  + Input to BNN = spectrum normalised by planck spectrum and centred around 1
* From readme:
  + Datagenerator reads data in format (by cols): k, redshift bins 1,2,3.
* Questions:
  + What does the datagenerator file do exactly (besides add noise and scramble example indices)? Is that it?
  + Why are there various power spectra for each theory if they are all computed by the same package with the same parameters? Different model parameters per iteration?
  + Why do unknown models necessarily produce signals correlated in space and time
  + What is MCMC / explain the bottom of the tree in paper.
  + Covariance formula page 4 of paper.
  + Is there a reason why BNN’s estimated classification probabilities are not representative of real probabilities (page 4)?
* How much theory do I need to understand for the two approaches suggested by ben? How would you suggest quickly absorbing the theory (suggest a review paper perhaps?)

Project Ideas:

* Ben’s suggestions: Why is the ML approach worth an entire project? Surely optimising the models and then evaluating generalisation is a reasonable project?
* Page 2 of paper, the idea of using well defined probability distributions which account for all sources of uncertainty.
* Page 3, inclusion alternate theories
* Modifying the network such that the classification probabilities are representative (page 4)

Theory to learn:

* Convolutional BNN in detail