WTF am i doing right now?

Malte Brinch
University of Copenhagen
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1. Getting the time lags for the torus

to do this we need to convolve the transfer function with the driving function and check it with all of the different filters. We want to use MCMC to get the uncertainty of the parameters. To use MCMC for this we need two things 1) the priors for the parameters and 2) the likelihood of the function.

2. The transfer function

we know the transfer function is some type of lognormal from Pancoast and Skielboe and Lynge wrote a form of it with the necessary parameters (though its a power law not a BB)

$$f(t,\lambda) = A_T \frac{1}{t\sigma_{dust}\sqrt{2\pi}} e^{-\frac{(ln(t)-\mu_{dust})^2}{2\sigma_{dust}^2}} + (1-A_T)N_{AD}BB(T,\lambda)\frac{1}{t\sigma_{AD}\sqrt{2\pi}} e^{-\frac{(ln(t)-\mu_{AD})^2}{2\sigma_{AD}^2}}$$

The first term is for the dusty torus and the second term is for the BLR (even though the values say Accretion Disk? I think the accretion disk is what is meant here).

We need priors for all of these parameters

- The uniform temperature of the dust torus T, is it needed if we do not use a blackbody? Otherwise the range would be something like 1300-1800K and we expect 1500K
- The natural log of the thermal lag μ_{dust} It is the natural logarithm of the mean value of the delay in the thermal transfer function. The prior is gotten from Edelson et al. (which paper?). Generally it seems to be days-weeks.
- The natural log of the width of the thermal lag σ_{dust}, again look at the Edelson et al. paper for the prior. Around 5 days seems to be reasonable, Though this is from Edelson et al. 2015 where they look at the accretion disk.
- The thermal fraction of the observed flux A_T. A measure of the relationship between the fraction of observed light originating in the Accretion Disk, and the Dust Torus. The prior here in different in different bands.
- The Accretion Disk transfer function normalisation N_{AD}. This value represents the fraction of the driving function energy that becomes re-emitted by the Accretion Disk in the relevant wavelength band. Again the prior here will be different for each waveband.
- The natural log of the Accretion Disk lag μ_{AD} look at the Edelson et al. 2015 paper for the prior of all the lags for each filter used.
- The natural log of the width of the Accretion Disk lag σ_{AD}. Again i think the best idea here is to use the width of the CCF centroid in Edelson et al. 2015.

3. The driving function

We do not know the functional form of the driving function but assume it is a Gaussian random process (DRW?) since the PSD slope might be -2. The Gaussian process is specified by its mean and covariance function. How do we convolve the Gaussian process driving function with the transfer function if we do not know its functional form? The values for the covariance matrix hyperparameters is found through maximizing the marginal likelihood. How do we specify the marginal likelihood for the Gaussian process? Maybe pymc3 has something.

4. Convolution/integration

how do we write the combined likelihood for the convolution? Do we just take the Fourier transform? No because then why would we need the MCMC to do the integral? Many articles do not even talk about the convolution and discusses just doing light curve fits. Do we need to do light curve fits? Or can we just work with the data points in each filter. Which MCMC algorithm should we use? Pymc3 or emcee?