Physics 345, Fall 2020, Project #1
Infrared Spectral Energy Distributions

Overview. Thermal emission from warm dust often dominates the far-infrared luminosity of galaxies, and it can even constitute a significant fraction of the total (bolometric) luminosity. Modelling the far-infrared spectral energy distribution (SED) can reveal the temperature of the dust along with a few parameters that characterize the emission. This is a valuable way to study the physical properties of galaxies and study galaxy evolution of a wide range of redshift. In this project you will fit models to observed far-IR SEDs.

Data. The NASA/IPAC Extragalactic Database (NED) provides a valuable compilation of astronomical data. You can search for an object and then click on the tab labeled "Photometry & SED" to find the data you need.

Setup. Blain et al. (2003, MNRAS, 338, 733) describe standard models used to fit far-IR SEDs. They apply four models to three different galaxies. You can focus on the first single-temperature model described in the first paragraph of their §2.1 ("model 1"). The parameters for this model are the dust temperature T, two power law exponents α and β, and a normalization for the curve (Blain et al. use the total luminosity, but you can parametrize it differently if you want).

Goals. Use NED to obtain the data for the three galaxies shown in Fig. 1 of the paper by Blain et al. Fit the SEDs with model 1 (essentially reproducing the solid curves in the figure). In each case, report the best-fit values of the lens model parameters, and use MCMC to characterize the uncertainties. Compare your results with those given by Blain et al.

Possible sub-analyses. In some cases NED contains multiple values for the photometry at a given wavelength/frequency; one possible sub-analysis would be to see how the choice of data affects the results. A more advanced sub-analysis would be to implement one of the other models discussed by Blain et al. I will be happy to discuss other ideas for sub-analyses for this project.