P6: Multi-messenger Astronomy: Cross correlations between GW sources and galaxies.

Background: GW standard sirens provide estimates of luminosity distances which can be used to infer cosmological parameters such as hubble constant. However, lack of localization and redshift estimates hinders such applications. Cross correlations between GW observations and galaxies has been proposed as a one promising way to estimate the redshift distributions of GW sources. Sensitive measurements of hubble constant using this technique still suffer from the systematic biases in the galaxy samples used. These lead to loss of precision and potentially biased estimates of hubble constant.

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Project Goal: We will formalize the analysis that can marginalize over the several known systematics in the galaxy samples and predict the expected precision on hubble constant estimates for future experiments. We will also attempt to reanalyze some of the existing datasets in the literature.

Necessary Concepts:

- Basic cosmology: Distance estimates, Galaxy clustering
- Basic statistics, coding in python and familiarity with packages such as numpy, scipy, matplotlib, astropy

Resources: There are several papers on cross correlations between GW and galaxies, such as: 2006.14961, 2007.04271. Familiarity with cross correlation redshifts is also helpful.