

# Semester-long project descriptions

## Project 1: How old are the Milky Way's star clusters?

Using brightnesses and distance estimates from Gaia, you'll create a color-magnitude diagram (CMD) for one of the Milky Way's star clusters. You'll then compare the CMD to theoretical models of stellar populations to determine the age of your cluster.

## Project 2: What do galaxies that host active galactic nuclei (AGN) look like?

Using a catalog of galaxy properties derived from Sloan Digital Sky Survey data, you'll classify galaxies as AGN-hosting or starbursting. You'll then investigate correlations between AGN activity and galaxy properties.

## Project 3: How fast is the universe expanding?

Using observations of Type 1a supernovae, you'll estimate the Hubble constant ( $H_0$ ; the expansion rate of the universe). You'll then compare your results to other  $H_0$  estimates from the astronomical literature.

## Project 4: What are the origins of the Milky Way's stellar streams?

Using observational data from Gaia, you'll identify stars that belong to one of the Milky Way's stellar streams. You'll then use the `gala` Python package to produce a model of your stream, which you'll compare to the real data you retrieved.

## Project 5: How can we measure the masses of exoplanets?

Using radial velocities derived from observations of exoplanet-hosting stars, you'll place constraints on the mass of the planet. You'll also explore how the assumptions you make about the host star's properties affect your mass estimate.

## Project 6: How do the different components of a galaxy affect its rotation curve?

Using the `galpy` Python package, you'll simulate simple galaxies with different components (disk, bulge, central black hole, etc) and quantify how the presence of those components affects the galaxy's rotation curve. You'll then compare your results to known trends from observations.

## Project 7: What affects the rotation speed of stars?

Using light curves from Kepler, you'll determine the rotation periods of a sample of stars with different properties. You'll investigate correlations between your rotation periods and the stars' properties (like temperature and surface gravity).

## Project 8: Choose your own adventure!

You're welcome to propose a project not listed above (or a modification of one of the projects listed above)! Please contact me ASAP