

# Ay20 project

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Due at start of lecture (11 am) on Friday Nov 22, 2019.

## 1 Introduction

To obtain observing time on telescopes, astronomers need to convince other astronomers that their projects are worth doing. This can be tough, because astronomers (like most academics) love to argue! It's also tough because (a) all astronomers think their own fields (e.g., exoplanets, supernovae, star-formation) are the most interesting and important areas of astronomy, and (b) many astronomers only have a deep knowledge of their own fields. So, as budding astronomers yourselves, we're going to practise this skill.

The final outcome of this project is going to be a two-page observing proposal (12-pt font, 1-inch margins). The structure is as follows:

1. **Scientific Justification.** This describes the scientific rationale for your project, and should address: the background for the project that shows why it is interesting/important; the scientific goals of your proposal; how you propose to interpret your results.
2. **Technical Justification.** This section should describe and justify technical requirements relevant to your proposal, specifically the choice of instrument, its configuration, and how long you need to observe over how many epochs. The main thing is to demonstrate the feasibility of your observations.
3. **Figures, tables, references.** Please include all of these items within the two-page limit.

## 2 Science question

The closest star to the Sun is currently Proxima Centauri, at 1.301 pc. However, this was not always the case, and won't remain so into the future. Stars are constantly moving, and for example a star moving at  $50 \text{ km s}^{-1}$  can travel 1 pc in just 20,000 years. *Using the [SIMBAD](#) database, I would like you to find a star that passes/passed within 2 pc of the Sun within  $\pm 100,000$  years of now.* This is important because such stars can perturb comets in the [Oort Cloud](#), causing them to approach the inner Solar System.

I would then like you to pick any one of these stars to study using one of the [Las Cumbres Observatory](#) (LCO) telescopes. Possible science questions include:

- What is the location of this star on the observer's H-R diagram (i.e., a stellar color-magnitude diagram), after accounting for possible variability?
- How often does this star flare, and how does its flaring behaviour compare with that of the Sun?
- Is this star orbited by any large planets?

A star's observed motion through space can be split into its radial velocity (positive if away from the Sun, and negative if towards the Sun), and its proper motion (apparent angular velocity on the sky). Clearly, a star is more likely to have encountered the Solar System if its proper motion is low! To identify your list of stars, you can use the query field in the [SIMBAD](#) page to select stars that are nearby (have large parallaxes), and have low proper motions. Be sure to set "Return" to "display", and use the description of queriable fields to define your search criterion. Then, for each star in the list, you can click on its identifier to get more information, like the proper motion and radial velocity. *Please begin your scientific justification by describing the methods you used to identify your star of interest.*

When planning your observations to address your science question, the LCO [Instruments](#) page is a good place to start. Page 4 of the [Getting Started](#) guide also neatly summarizes the imaging instruments and the range of magnitudes accessible with each instrument. Please use the [Exposure Time Calculator](#) in justifying your observing request.

### 3 Tips for writing your proposal

- You can assume that all the stars have linear trajectories, entirely described by the proper motions and the radial velocities.
- The best place to find information on many of these stars is Wikipedia. All publications relating to these stars can also be found in the “References” section of the stars’ SIMBAD pages.
- If you want to do spectroscopy rather than imaging with the LCO instruments, I suggest that you send me an e-mail so that we can schedule a time to discuss your plans! Imaging is a lot easier.
- There is no “right answer” here. Please just do your best. Observing proposals are typically graded on a relative rather than absolute scale, and I will be applying that principle here. The primary grading criterion will be how well the requirements of the scientific and technical justification sections are addressed.