[Project Proposal Title]
[Project Proposal Title Continued]

Final Project Proposal

Introduction to Python

Astronomy Division

MM/DD/YYYY

Group Members:

[Member 1, in Alphabetical Order, by Last Name]

[Member 2]

[Member 3]

[Member 4]

[Member 5]

[Member 6]

1 Abstract

The abstract (**150 word limit**) serves to give a broad overview of your project aims to investigate and what you hope to find.

Adapted from the Berkeley Library Guide (https://guides.lib.berkeley.edu/publish): The abstract functions as an outline of the paper, including:

1. What is the problem domain (system under investigation)?
2. What is the specific research question?
3. What were the methods and results?
4. What are conclusions do you hope to find and why are they significant? What results do you expect?

Example: Nunez JK, Bai L, Harrington LB, Hinder TL, Doudna JA. 2016. CRISPR immunological memory requires a host factor for specificity. Molecular Cell 62: 824-833.

Abstract: [**Problem domain**] Bacteria and archaea employ adaptive immunity against foreign genetic elements using CRISPR-Cas systems. To generate immunological memory, the Cas1-Cas2 protein complex captures 30-40 base pair segments of foreign DNA and catalyzes their integration into the host genome as unique spacer sequences. [**Research question**] Although spacers are inserted strictly at the A-T-rich leader end of CRISPR loci in vivo, the molecular mechanism of leader-specific spacer integration remains poorly understood. [**Methods and results**] Here we show that the E. coli integration host factor (IHF) protein is required for spacer acquisition in vivo and for integration into linear DNA in vitro. IHF binds to the leader sequence and induces a sharp DNA bend, allowing the Cas1-Cas2 integrase to catalyze the first integration reaction at the leader-repeat border. [**Conclusions**] Together, these results reveal that Cas1-Cas2-mediated spacer integration requires IHF-induced target DNA bending and explain the elusive role of CRISPR leader sequences during spacer acquisition.

2 Background

This is where you will give some background on your project idea. **You should cite references (other research papers) throughout this entire paper and these references should be listed at the end of your proposal.** Try searching for papers in your sub-field and checking out those abstracts. **Do not copy the work of others**, but you may rephrase it in a way that fits your specific problem. You are also encouraged to include properly cited figures in your proposal.

An example: Transition metal dichalcogenides (TMDCs) have recently emerged as a new class of structurally and electronically similar two-dimensional (2D) materials with important applications in optoelectronics, spintronics, and flexible electronic devices. TMDC monolayers exhibit a number of interesting properties such as a direct bandgap, strong spin-orbit

coupling, and high carrier mobility. TMDC monolayers can be reassembled into heterostructures that mimic layered field-effect transistors, held together by existing van der Waals interactions between layers in the bulk crystals. Two-step chemical vapor deposition (CVD) growth of TMDC heterostructures presents a comparable wafer-scale alternative to mechanical exfoliation. Two materials of particular interest are Molybdenum Disulfide (MoS_2) and Tungsten Disulfide (WS_2), which are electronically and structurally similar TMDC semiconductors.

3 Research Question

This is where you will detail your project idea. You should do this by talking about the specific papers that inspired your experiment. Again, cite them. The idea of this proposal is to provide a complete snapshot of your project. Talk about kind of the big picture that lead you to the idea. For example, what papers inspired you to pursue this project?

You should have a testable question and a prediction, or possible hypothesis for how this will go. In research, a hypothesis is not a prediction, but more of a goal. You're looking to answer the question, not necessarily confirm a prediction. In other words, you might not know what you will find when you start examining, say, an exoplanet. But you want to learn more about it and allow your discovery process to kind of guide your quest for the answer. For example, you might find evidence that the exoplanet's atmosphere is really interesting, and then you might find that the atmosphere is a result of some interesting geothermal structures, and start exploring those as well. But you should kind of define a loose goal in this case. If you want to make a graphene device, perhaps, you might want to figure out the most viable growth method, but you might end up exploring different aspects of that in practice.

More examples: Here, we aim to use a convolutional neural network to characterize TTVs, extracting parameters that are invisible to single-planet transit analysis alone. We anticipate that our model will be able to determine the mass of the companion planetary body from the input light curve, despite the low-SNR regime of the signal.

4 Methods

You should detail methods here. Talk about equipment you want or need, and the equipment and methods you want to copy. A lot of new research comes from replicating previous experiments and using the results to explore new territory. For example, you might copy a graphene growing method from a paper, and then use that sample to create graphene heterostructures and do your own independent research.

If your project has a computational component, you must list software or datasets that you plan to use here.

Example: To produce a training sample for our CNN, we calculate randomized center-of-transit times with TTVFast and generate light curves with the BATMAN code. We then add

gaussian white noise to achieve varying SNRs. We also intend to insert long-term trends to simulate correlated, or "red," noise, inspired by common systematic errors from the Kepler spacecraft. Additionally, we inject false positives into the data — namely, simulated light curves from eclipsing binary systems. Finally, we feed this data to our CNN, which is built using the Keras API.

References

You'll be citing references in this part. **Use may use any format. You need at least 2 references, but you will most likely need more.** Remember that you can only access a lot of scientific journals on university networks. You can set up a proxy to get circumvent this restriction (see Berkeely EZproxy).

Details on how to cite in LaTeX via Overleaf and Mendeley will be presented at the LaTeX workshop.