OPTI 416
Team Project Summary

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This paper outlines the three team projects that were studied over the course of this semester. The goal of the first project was to design an observation plan to search for exoplanets transiting about known radial velocity targets. Through the second proposed team project, LBT's current design was analyzed to see how an interferometer could be used to detect and characterize hot Jupiters. The third and final project was to design an external occulter to be used to better observe Earth-like planets.

The goal of the first project was to determine how radial velocity is used to detect exoplanets, and to propose an observation plan. At first, our team was confused about how to approach this problem. The concept was very open-ended, and none of us (or myself at the very least) were unsure of where to start. We had determined that the general design of the telescope was up to us, and that we were to assume that we knew what targets to observe. Once we got our minds wrapped around this, we began to break the project into parts that we could tackle individually. These parts were 1) general motivation and goals, 2) overview of radial velocity 3) transit time and depth predictions 4) noise constraints, 5) observation plan, and 6) current similar projects. As this was the first project, we initially tried to work on all of these parts together. This turned out to be pretty difficult, as all of our schedules were so different. We ended up working on parts individually as well. My main focus was to study the limiting factors of transit detection, which were photon and scintillation noise. During the presentation, I talked about what causes the photon and scintillation noises and methods to correct them.

The second team project of the semester was looking at the design of LBT (specifically the interferometer LBTI) and how it would be able to detect and characterize hot Jupiters. Similarly to the first project, we broke up this one into several parts that we could all work on: 1) project review, 2) interferometric techniques, 3) current interferometers that observe hot Jupiters, 4) LBTI, 5) would LBTI work for our target constraints, 6) noise calculations and concluding remarks. I focused on different interferometric techniques, and how they can be used to detect different targets. I approached this by first outlining the pros and cons of using interferometers, their general layout, and several relevant equations. This project allowed our team to better understand the capabilities and limitations of LBT.

Finally, in the last team project, my team and I looked more closely at how occulters are used to detect and characterize exoplanets. We were to design a plan that specifically uses an external occulter with a non-coronographic telescope. First, as usual, we discussed what we thought the goals of the project were (ground or space, system and target parameters, what information can be learned from this, and the major issues and limits). Then we broke these into different categories that each of us could work on. These categories were 1) general motivation for the project and project goals, 2) coronagraphy and occultation review, 3) pros and cons of each, 4) our proposed design, 5) our observation plan, 6) results and concluding remarks. I covered the second section, which was a review of the occultation process that we were interested in. Once all six of us finished our individual parts, we met up again to combine everything and to make sure none of us were missing any important information. After the presentation, the only slide that was added was one on the pros and cons of using single or multiple occulters (which I added). I did learn much about the use of external occulters to observe exoplanets, including why they have the flower shape (diffracted light is suppressed before it reaches the telescope) and what the main issues of this method are (cost and project lifetime). I would have to say that this was my favorite team project because the method seems very promising.