Active galaxies can be classified into three sub-types; Blazars, Seyfert, and Quasars, based on the orientation of their relativistic jets to the observer. A central engine composed of a supermassive black hole powers these active galaxies. Due to physical and technological limitations the center of these galaxies remains a mystery and cannot be studied directly. However, by studying the jets we can indirectly determine the properties of the central engine that power these galaxies.

When I began my research, I was focused mainly on blazars and their variability on short time scales, i.e. over the course of a night, called microvariability. Attempts to measure the variability in different wavelengths, primarily R and V were made. Models of the relativistic jet emission predict that a lag in variation would be seen in the V and R optical bands. This is significant because it is one of the few ways to directly test the predictions of the emission models. I spent multiple nights observing different blazars trying to find one that was in an active state so that its variability could easily be discern. Unfortunately, for most of the nights, any variability that was present was smaller than the error bars. As discouraging as this was, it was the primary reason that led me to the next part of my research, variability in Seyfert galaxies.

Through sheer coincidence a new object was added to the observing list for the telescope operators, 3C 120, which led me to the next part of my project. 3C 120 is a type-1 Seyfert galaxy, meaning both broad and narrow line emission lines are present. Having only been focused on microvariability in Blazars, I was curious whether Seyfert galaxies would vary in the same way. After going through the literature for 3C120 it became apparent that while the object was known to be highly variable, there was no published work on its microvariability. Therefore, since I was not having much success of detecting microvariability in Blazars, I proposed that observations on 3C 120 should be run over the course of a night to see if I could detect microvariability. This project is still ongoing; however, the observations have been limited due to weather and recent mechanical problems with the observatory.

Both of these projects involved tedious image processing, which I did by using a software package called Image Reduction and Analysis Facility (IRAF). This along with my regular duty of keeping up with our regular blazar images led me to create a streamlined process, to be used for a pipeline for increasing the data flow. After doing some investigating and learning some new programming in IRAF, I was able to create a program that would process our images in a fraction of the time that it took before. The reason this is important is because the skills that I picked up from learning how to write new programs has become invaluable to my newest research.

Over the past semester I have started doing work on detecting the "noise" processes within microvariability. Noise in this context actually refers to the signal and its behavior over time. Understanding this process provides information on the physical mechanism driving the observed variations. To examine its behavior I used structure function analysis to find the type of noise processes present: flicker, white, or black noise. The challenge in this was that I was using a program written by someone else using a different version of the Interactive Data Language (IDL). I spent majority of my time trying to make his version of the program compatible with our version of the software. However, with the knowledge I had picked up from writing my own routines, I was able to eventually get the program to work. I discovered that for most of the nights there was a combination of shot and black noise present. I am now in the process of running the program on randomly generated light curves that have been modeled to fit the different types of noise process. Since the noise process can also be determined using Fourier Transform, I plan on testing the relationship between the power density slope of the Fourier Transform to the slope of the structure function for finite data sets. Preliminary results show that for flicker noise processes the relationship does not hold true, more investigation is needed to see if an offset can be added to correct for the discrepancies.