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Eighty-one Pixels: Project Week 2015

I was prepared to study something very particular when I walked into the Harvard-Smithsonian Center for Astrophysics, but I was not prepared for exactly how miniscule the project was that I would be studying for the next five days. After being towed through the extremely confusing building to my office by my official mentor, Dr. Jeremy Drake, I was presented with the download link to an x-ray image of T Aurigae, a nova¹. Dr. Drake's wife, Dr. Antonella Fruscione, who also works at the CfA and became my mentor for all things to do with software, introduced me to the applications I would be using for my project: CIAO, Sherpa, and DS9. Although I had been apprehensive before I arrived, worrying that perhaps I was not qualified to work at the CfA, Dr. Fruscione made it clear that no one expected me to be able to use the software right away. Shortly thereafter, I began work on the image of T Aurigae. My ultimate goal was to find out if the image was extended or not, i.e., if the light came from a point source or from a blob. If the x-rays had come from an extended source, they would be coming from the accretion disk around the stars, but if they emanated from a single point, the binary system was more likely to be a polar with a very strong magnetic field that had destroyed the accretion disk.

I sat down at my desk, glancing rather nervously at the other adult workers in the room, each of them with at least six different applications running on the same screen, and opened up DS9 to take a look at T Aurigae. I quickly discovered that using the applications was not difficult at all, especially with the extensive help manuals on the CIAO website, and my extremely rudimentary knowledge of the command line was more than enough to let me do everything I needed to do. The first thing I did was find the net count, which is basically the

¹ A nova is an explosion on a white dwarf in a binary system, when the white dwarf pulls material from its companion star onto itself.

number of x-rays captured. The image I was focused on comprised eighty-one photons, stacked on top of each other at denser places. Only when I saw this did I comprehend the true tininess of the image I was looking at.

Within the first few hours of studying T Aurigae, I discovered that my fellow desk workers were not as intimidating as they appeared. Periodically I would glance at someone else's monitor to discover them watching boxing, cooing over a picture of their baby their husband had taken, or looking at a meme they'd been sent from elsewhere in the office. Only the man on my immediate right spent all his time actually working. I was greatly amused by the lack of focus prevalent among the younger employees.

Despite the interruptions of a snowstorm and the resulting incompetency of the Boston public transport system (half an hour to get across the Mass Ave. Bridge!), I managed to get all the information I needed about T Aurigae. It turned out to be a point source, and probably a polar as a result. I am in the process of writing an Astronomer's Telegram, or ATel, about it, with a lot of help from my two mentors. When the ATel is posted on the website, I will have officially become a part of the vast database of astronomers online!

Doing my project at the CfA was one of the most fun things I have gotten to do in a while. I spent hours fiddling around with computers, hacking my way through the internet to find obscure commands to help me graph different fits for the data, and sending desperate emails to Dr. Fruscione whenever something odd happened, which was often. Dr. Drake was very interesting to talk to and taught me quite a few things about astrophysics in general, while both Dr. Fruscione and Dr. Drake were extremely patient when I tangled myself up in command-line confusion. I did not expect to learn as much about computers as I did, nor did I think that it was possible to have so much fun manipulating an image of a binary that, at the scale with which the application opened the picture, was about the size of the period at the

end of this sentence. This project was deeply satisfying and very enjoyable, and has spurred me on to continue searching for opportunities to study astrophysics in the future.