

Excerpted from a senior thesis by George Miller:

A REFLECTION ON THE WHITE DWARF FRI STREAM AND ADVICE TO INCOMING STUDENTS

The Freshman Research Initiative at the University of Texas at Austin began in 2005 as an opportunity for entering freshmen to gain first-hand experience in real research labs. While initial “streams” focused mostly on biology and chemistry, Don Winget and Mike Montgomery began the White Dwarf Astronomy FRI stream in 2009. As of 2012, The WD stream has admitted 6–8 students per year with interest in astronomy research. The stream has a tiered organizational structure, flowing from the PI (Don Winget) and the research educator (Mike Montgomery) to a graduate student TA and undergraduate mentors. The first semester of each new group (beginning in the spring) is divided into two separate components. For the first half of the semester, students complete planned labs designed to teach them facets of WD astronomy ranging from basic knowledge of UNIX to light curve analysis. During the second half of the semester, each student is assigned an individual research project that he/she works on. Each of these projects is on the frontier of research with unknown solutions and the potential for future exploration. While students during the first semester often must be guided by their mentors/TAs, the students are encouraged to work much more independently during the second semester. Throughout the entire year, there are weekly lectures delivered by the research educator (Mike Montgomery) beginning with the basics of “*what is a white dwarf?*” and leading toward more complex concepts.

I was among the first students to enter the WD FRI stream in 2009, and have been a peer mentor for the next three years. As the first among the graduating white dwarf FRI students, I have a unique perspective on its impact on student success. It is my goal, therefore, for this work to serve as a guide for younger FRI students, explaining how one can get the most out of this wonderful opportunity presented to them. For myself, the FRI made a profound impact on my development as a scientist and I hope it will yield the same results for every future entering freshman.

The foremost lesson I can impart on younger students is the importance of getting your hands dirty with research. Astronomy is an enormous field, and to fully understand even something as specific as white dwarf stars is a near impossible feat in four short and busy undergraduate years. Research is the key to unlocking any understanding of astronomy as an undergraduate. The practice of thinking critically about your work is far more valuable than reading about someone else’s. Reading textbooks and journals is necessary to gain an understanding of the field, yet asking the question “*what could possibly make my data look like this*” is considerably more insightful than thinking “*their data looks like this because the author says so*”. When reading a journal, I find it more important to take away how the research was carried out than the actual results. Research also has an important psychological aspect. As a freshman entering research, I felt drastically inferior to those above me. *How can I possibly ever understand as much as they do?* Yet, I remember the ecstatic pride I felt when obtaining my first results. I had discovered something about the universe that no one else knew. From that moment on, I knew that I could succeed in astronomy.

The key to doing research as an undergraduate is persistence and dedication. Rarely are interesting problems ever thrown at you and rarely can interesting results be achieved without hard work. Your professor and advisors are wonderful resources, particularly in the first stages of your learning, yet you must take the initiative in your own research. Always ask yourself “*what is the next level I can take this project*”. To be

selected to work on NN Serpentis with the University of Göttingen, I had to show eagerness and ambition towards the project. I was initially trained to use the MONET telescope as a student resource for school teachers using the telescope for outreach. The decision to develop the MONET for time-series white dwarf photometry was purely on my own accord and I became the first astronomer at UT to use the telescope for research. You are in charge of your own research, and it is solely up to you to make your research stand above others.

At the same time, you must learn to effectively use all the resources at your disposal. Perhaps the most important of these resources is your own peers. Establishing good relations with your fellow students is not only essential for your research, but your growth and happiness as well. Whenever I have a question regarding my research, be it a computer code that isn't working properly or a problem reducing a night's run, I always first turn to the students working in my lab. Having a conversation about your research is one of the best ways to understand it, and there are no better listeners than your fellow struggling peers. Over the four years I have worked in the white dwarf lab, I have grown to deeply cherish the friends I made my first year. They both keep me sane and deepen my passion for astronomy.

I am confident that I owe most of my success in astronomy to the white dwarf FRI stream. Without the motivation FRI placed on me, I doubt that I would have built the courage to begin research until well into my undergraduate career. Beginning research as a freshman impacted my entire undergraduate development, from classes to general excitement about the field. The FRI astronomy stream has trained me to be an astronomer, a researcher, a peer, a collaborator, and foremost a thinker. I have had the wonderful opportunity to watch the program transform the future of three entering classes of freshmen just as it transformed mine. While I leave to continue my career elsewhere, I am gratified and humbled to leave the future of my work in fully capable hands.