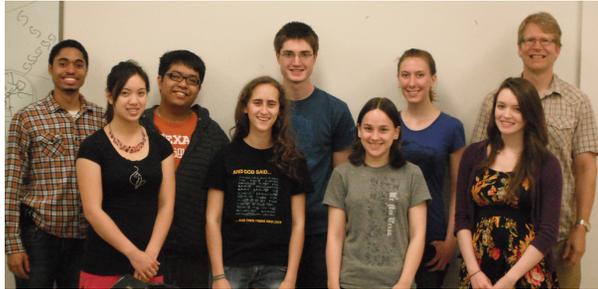


Exploring the Physics of the Universe with White Dwarf Stars

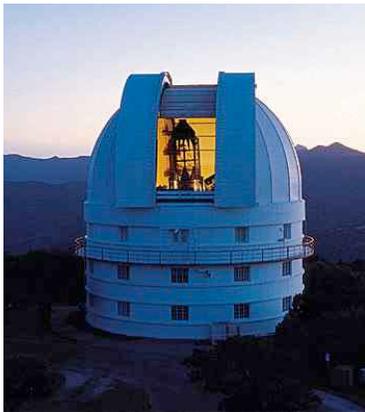
Our research group uses white dwarf stars to study many fundamental questions in physics and astronomy.



These include:

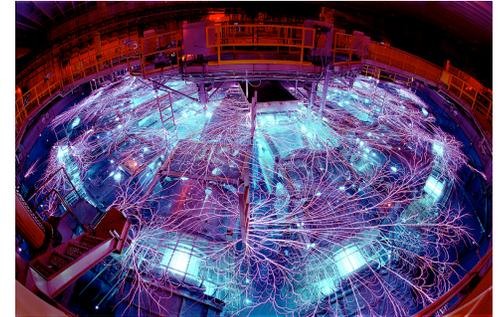
- What is the age of the universe?
- What is the mass of the (hypothetical) axion particle?
- How and when does crystallization occur in a dense stellar plasma?
- How does convection operate in a high-gravity environment?
- Are neutrinos emitted at the expected rate in white dwarf interiors?
- Do white dwarf systems contain orbiting planets?

In the Spring semester, students learn the basic concepts involved in our research, such as harmonic motion and simple thermodynamics, and these are illustrated in labs. They also make computer-based “experiments” which reinforce this knowledge and allow them to explore entirely new physical effects. During the Summer, they travel to McDonald Observatory to obtain data for one of our many projects, and they begin the reduction and analysis of this data. In the following Fall semester, they finish this analysis and place the data in the larger context of our ongoing programs. As appropriate, results are readied for publication.



Many of our students have had the experience of making new discoveries, uncovering a puzzle or inconsistency which had lain unnoticed. This process of generating new knowledge—learning something about the universe no one has

ever known before—is formative and begins their transformation from student to scientist. On a smaller scale, many students have remarked that the concepts we teach are also being introduced in some of their other classes and that they find the concepts much easier to understand in the context of our stream. We see this as a validation of the FRI concept and also as a demonstration of the deep resonance of our stream with the Physics and Astronomy curriculum.



The success of the current model is due to the intense interaction of the students with the faculty member, the Research Educator, and the student mentors. Our stream has recently graduated its first class of seniors: Jennifer Ellis, George Miller, and Kevin Luecke. All have won numerous awards and are pursuing their first-choice career options: the University of Colorado for Jennifer, Harvard University for George, and the Kinect Division at Microsoft for Kevin. In addition, George was the grand prize winner of the 2012 George H. Mitchell Student Awards for Academic Excellence (\$20,000 prize), Jennifer won a 3-year NSF Graduate Fellowship in Physics, and Kevin was selected Student Employee of the Year at UT-Austin for the 2012-2013 school year.

We look forward to having you in our stream.

Mike Montgomery
Don Winget

Mike Montgomery
Don Winget
Department of Astronomy
The University of Texas at Austin

Stream Information

URL: <http://rocky.as.utexas.edu/~mikemon/FRI/ast2.html>

Faculty Stream Leader:

Don Winget

Research Educator:

Mike Montgomery

Lab:

RLM 15.201

Equivalent credit for:

PHY 101L

CNS programs with large overlap:

Astronomy, Physics,
Math, Computer Science