10th Annual Undergraduate Research Symposium Abstract Submission

Student Names: Britney Biltz (space physics), Noura Ibrahim (astronomy), Brennen Moore (space physics) (College of Arts and Sciences)

Mentor Names: Dr. Andri and Ellie Gretarsson

Abstract: Research in Optics for Gravitational Wave Detection

B.Biltz uses a horizontal “Zollner style” pendulum to monitor changes in the local gravitational field. The pendulum is attracted to the moon and the Sun and so, as the Earth turns, the pendulum’s equilibrium point shifts within a 24-hour period. This is an experiment designed to test the limits of such a pendulum. This sort of system may be useful as a method of monitoring and correcting for gravity gradient noise in future gravitational wave detectors.

N.Ibrahim characterizes thermo-optic noise in high-performance mirror coatings of the type used in Advanced LIGO. To characterize thermo-optic noise, she measures the change in the transmission spectrum of prototype optical coatings as a function of temperature. Thermo-optic noise doesn’t affect the current Advanced LIGO interferometer, but it is likely to become a significant noise source for later generations of gravitational wave detectors.

B.Moore aims to measure the scatter from defects in Advanced LIGO style optical coatings and compare the results to Mie Scattering profiles. Such defects may lead to significant low frequency noise, preventing the detection of distant binary black holes and other low frequency sources. Hopefully, an understanding of the scattering profiles will help us understand how to ameliorate the noise.