PHYSICS
COLLEGE OF ARTS AND SCIENCES

SUMMER RESEARCH OPPORTUNITIES FOR UNDERGRADUATE students

FOR APPLICATION YEAR: 2026

PROJECT TITLE: Tools for galaxy survey cosmology

Jessica Muir
Department of Physics
400 Geology/Physics Bldg.
Cincinnati, OH 45221-0011
muirjc@ucmail.uc.edu

Project Description

By performing statistical analyses of galaxies that trace overdensities in the distribution of matter which span millions-to-billions of lightyears, we can learn about the fundamental physics governing the properties and evolution of the Universe. A primary goal of this is to test possible models describing the mysterious dark energy and dark matter which make up 95% of the mass and energy density of the Universe. In conducting these inferences, we face a number of challenges related to separating out signals of fundamental physics from uncertainties related to the properties of observed galaxies, as well as finding ways to efficiently test new proposed cosmological models.

This project will be in the area of theoretical cosmology (physics, more generally) and will focus on developing theoretical and statistical tools galaxy survey data analysis. An UPRISE student working on this project will join weekly cosmology group meetings, and will have regular meetings with the faculty mentor (and potentially a graduate student mentor). The project will include doing background reading to build understanding of the cosmology and statistical concepts needed for the project, using python code and scientific software to perform calculations. Experience with python programming and statistics would be beneficial for this project, but is not required.