

PHYSICS
ARTS AND SCIENCES

SUMMER RESEARCH OPPORTUNITIES FOR UNDERGRADUATE students

APPLICATION DEADLINE: 02/25/2022

PROJECT TITLE: Observational Astrophysics and Cosmology

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Project Description

Observational cosmology is the study of the structure, the evolution and the origin of the universe. We use a wide range of observational techniques to measure the properties of the universe from the present day to tens of billions of years ago. Dr. Bayliss' group at UC is involved in several different observational cosmology projects that aim to constrain the large scale structure of the universe (i.e., a statistical description of how matter is distributed throughout the universe). This work mainly uses studies of massive galaxy clusters, which are the largest gravitationally bound structures in the universe, with the typical galaxy cluster having a total mass of 10^{14} to 10^{15} times larger than the mass of the Sun.

The UPRISE student will work on a project related to current ongoing work in Dr. Bayliss' research group, most of which is focused on studying the physical properties of massive galaxy clusters. Current topics of research focus on using gravitational lensing effects (bending of light due to the large amounts of mass concentrated in the clusters) to directly constrain the distribution of matter within the galaxy clusters, and also use the magnification from the lensing effects to detect and characterize very distant background galaxies.

This project will involve a large amount of data analysis and/or data mining, as well as data visualization. Computer programming will be a core element of the project, and so prior experience coding in a common language (e.g., Python), as well as experience using command line unix/linux systems would be extremely helpful. In addition to astrophysics content, the project will also involve a significant amount of statistical analysis and error propagation.