

UCLA Division of Astronomy & Astrophysics

Astronomy Colloquium

Wednesday, April 8 at 3:30 PM

Room 1-434 PAB



Dr. Earl Bellinger
Yale University

**“Probing the physics of the early universe
with pulsating stars”**

The dawn of the universe left behind relics that can still be observed today, ranging from the oldest low-mass stars hiding in the Galactic halo to the seeds of the earliest supermassive black holes at high redshift. Unearthing these fossils requires confronting the deluge of big observational data from space missions like Kepler, TESS, Gaia, and JWST with big theoretical data from large-scale numerical simulations like MESA, GYRE, RSP, and FIRE. In this talk, I will present recent results from the Yale Astro Machine Learning (YAML) group, and show how we are using pulsating stars to constrain the physics of the early cosmos across a wide range of scales. I will discuss the search for the first generation of stars, and show how asteroseismology, the study of stellar pulsations, is uniquely capable of revealing their primordial nature. I will introduce our new nonlinear hydrodynamic stellar models, which we are using to characterize the variable stars that probe the Milky Way's dwarf galaxies. Finally, I will extend this analysis to the high-redshift universe, where JWST has recently uncovered a population of compact, red objects ("Little Red Dots"). Using our new code, MESA-QUEST, I will demonstrate that these objects are consistent with "quasi-stars": supermassive envelopes powered by the accretion of a central direct-collapse black hole. By analyzing the evolution and pulsations of these objects, I will show that we may have finally unearthed the origin of the first supermassive black holes.

Hosted by professors: Smadar Naoz, Alice Shapley, Erik Petigura