UCLA Division of Astronomy & Astrophysics

Astronomy Colloquium

Wednesday, Nov. 18 at 3:30 PM
Room 1-434 PAB

Dr. Joel Leja
(Penn State University)

"Again! - but faster, better, and with more physics: ML-accelerated inference of galaxy properties in deep and wide surveys of the universe"

The inference of the physical properties of galaxies at cosmological distance requires modeling a wide range of physics, including e.g. stellar evolution and atmospheres; dust attenuation and re-emission; nebular physics; AGN emission; and more. Bayesian inference is often used to map this space, and the wide range of physics and large parameter space (30-40 dimensions!) means these codes are not fast. Yet current and near-future surveys of the universe yield spectra for millions of galaxies, and imaging for billions. I will introduce the next-generation solutions, ranging from neural net emulators of key physics (photoionization modeling; stellar spectra) to efficient gradient-enhanced GPU-accelerated high-dimensional sampling to rapid simulation-based inference. These yield speed-ups of somewhere between hundreds and millions, with different trade-offs in flexibility and accuracy. In addition to permitting sophisticated high-dimensional modeling on the industrial scales of modern surveys, I will discuss qualitatively new science directions enabled by these breakthroughs — as modeling entire galaxy populations rather than one-at-a-time approaches, extremely high dimensional modeling of individual systems, e.g. spatially resolved modeling, and new data-driven modeling with the promise to finally address critical systematics in this field.

Hosted by Professors Smadar Naoz and Alice Shapley