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Current progress and challenges from the Cosmology and Astrophysics with Machine Learning Simulations (CAMELS) project

Monday, November 27, 2023 3:30 PM (15 minutes)

Large-volume cosmological hydrodynamic simulations have become a primary tool to understand supermassive black holes (SMBHs), galaxies, and the large-scale structure of the Universe. However, current uncertainties in sub-grid models for core physical processes such as feedback from massive stars and SMBHs limit their predictive power and plausible use to extract information from extragalactic surveys. In this talk, I will present an overview of the Cosmology and Astrophysics with Machine Learning Simulations (CAMELS) project, containing thousands of simulations implementing different cosmological and astrophysical parameters, sub-grid galaxy formation implementation, and hydrodynamics solver, and designed to train machine learning algorithms to maximize the extraction of information from cosmological surveys while marginalizing over uncertainties in sub-grid physics. I will show illustrative examples of the broad range of possible applications of CAMELS, discuss recent progress and challenges building robust simulation-based inference models for cosmology, and advertise the latest additions to the ever-growing CAMELS public data repository.

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