

Drummond Fielding – Colloquium – October 19, 2023
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Title: **Bridging the Divide: A Multi-Scale Approach to Galaxy Formation**

Abstract:

Galaxies lie at the nexus of modern astrophysical pursuits. They are an essential cosmological probe, and set the environment in which stars form and compact objects merge. As such, galaxies are crucial to all of astrophysics, and yet our grasp of how they evolve is incomplete. The key lies in understanding the complicated balance between inflows and outflows that shape galaxies and regulate the amount of fuel available for star formation and black hole growth. Understanding these galactic gas flows has, to date, been inhibited by the seemingly insurmountable range of spatial and temporal scales inherent to the governing processes. I will describe my efforts to bridge this vast range of scales and illuminate the principles underlying galaxy formation using pioneering simulations and innovative machine learning approaches to forward model, accelerate, and interpret. We will cover how micro-scale (\sim sub-pc) processes, such as turbulent mixing and radiative cooling, connect with meso-scale (\sim kpc) processes, such as supernova-driven galactic winds, and how—when combined using novel multi-scale techniques—they shape the macro-scale (\sim Mpc) galactic properties and dynamics. Taken together, these efforts aim to usher in a new era of truly predictive galaxy modeling.