

High Energy Physics Lunch Seminar

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"Machine Learning Dark Matter Halo Formation"

Host: Andrew Hearin

September 10, 2019 – 12:00 p.m.-1:00p.m. Building 362/F-108

Abstract:

Dark matter halos are the fundamental building blocks of cosmic large-scale structure. Improving our theoretical understanding of their structure, evolution and formation is an essential step towards understanding how galaxies form, which in turn will allow us to fully exploit the large amount of data from future large-volume galaxy surveys. Although N-body simulations are the only tool to fully compute the non-linear gravitational evolution of halos, it is difficult to gain physical interpretation from numerical studies alone. I will present a machine learning approach which aims to provide new physical insights into the physics driving halo formation. We train a machine learning algorithm to learn cosmological structure formation directly from N-body simulations. The algorithm infers the relationship between the initial conditions and the final dark matter halos, based on inputs describing different properties of the local environment surrounding the dark matter particles in the initial conditions. By evaluating the predictive performance of the algorithm when provided with different types of information, we are able to infer which aspects of the early-Universe density field impact the formation of the final dark matter halos. In general, our approach can be extended to yield physical understanding of other complex non-linear processes in the context of cosmological structure formation and beyond.

HEP Lunch seminar info:

Please use the doodle poll to sign-up for lunch at https://doodle.com/poll/i6cua3azkwnhrveq

Chicken Sandwich \$8, Sub Sandwich \$9, Salad \$7, Slice of Pizza- \$5 (all include coffee). Coffee 25¢. Pop or Water 75¢.

The HEP Lunch Seminar Schedule can be viewed at: https://indico.fnal.gov/event/21415/