Contribution ID: **271** Type: **Invited talk in a parallel session**

Causal discovery in astrophysics

Thursday, July 11, 2024 5:00 PM (27 minutes)

Causal discovery techniques have been introduced in the context of machine learning with the goal of finding and constraining causal relations between variables. Multiple algorithms for this task are available, amounting to different operational definitions of causal relations based directly on observational data. These tools have found wide application in disciplines that have limited access to experimental manipulation, such as economics or epidemiology. However, in physics, even in a purely observational context such as astrophysics, causality has historically been understood exclusively in the context of a theoretical framing of some sort: astrophysics describes causal relations through theoretical models and, more recently, simulations. Data-driven causal techniques could prove complementary to this approach, but as of now have virtually never been applied to astronomical data.
I will show through concrete examples that a data driven approach to causal questions in astrophysics is viable and useful for resolving long standing issues. Moreover, I will discuss critically how it meshes with theoretical understanding, arguing that this is a major area for development of machine learning in astrophysics.

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Session Classification: Cosmic Insights from Big Data: How Machine Learning is Decoding the Universe

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