

Prospecting for New Physics through Flavor, Dark Matter, and Machine Learning

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Astrophysical searches for particle dark matter using neural simulation-based inference

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The complexity of astrophysical data and presence of unknowable systematics poses significant challenges to robustly characterizing signatures of dark matter in many datasets using conventional methods. I will describe how overcoming these challenges will require a qualitative shift in our approach to statistical inference, bringing together several recent advances in probabilistic machine learning, differentiable programming, and simulation-based inference. I will showcase applications of these methods to the analysis of Fermi gamma-ray data, with implications for the Galactic Center Excess, and the analysis of stellar kinematics of stars bound to dwarf galaxies, aiming to uncover the latent dark matter density profiles with implications for the nature of self-interactions in the dark sector.

Summary

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Session Classification: Dark Matter Indirect Detection