Contribution ID: **241** Type: **BSM Theory Developments**

Towards AI-assisted Neutrino Flavor Theory Design

Monday 25 August 2025 11:40 (20 minutes)

Particle physics theories, such as those which explain neutrino flavor mixing, arise from a vast landscape of model-building possibilities. A model's construction typically relies on the intuition of theorists. It also requires considerable effort to identify appropriate symmetry groups, assign field representations, and extract predictions for comparison with experimental data. In this talk, I will discuss a new strategy ro construct a model. We developed an Autonomous Model Builder (AMBer), a framework in which a reinforcement learning agent interacts with a streamlined physics software pipeline to search these spaces efficiently. AMBer selects symmetry groups, particle content, and group representation assignments to construct viable models while minimizing the number of free parameters introduced. We validate our approach in well-studied regions of theory space and extend the exploration to a novel, previously unexamined symmetry group. While demonstrated in the context of neutrino flavor theories, this approach of reinforcement learning with physics software feedback may be extended to other theoretical model-building problems in the future.

Authors: GHOSH, Aishik (University of California Irvine (US)); WHITESON, Daniel (University of California Irvine (US)); RUDOLPH, Jake (UC Irvine); BARETZ, Jason (UC Irvine); FIEG, Max (University of California Irvine (US)); KNAPP-PEREZ, Victor (UNAM)

Presenter: FIEG, Max (University of California Irvine (US))

Session Classification: Parallel