Contribution ID: **112** Type: **not specified**

Anomalous electroweak physics unraveled via evidential deep learning

Wednesday 26 March 2025 16:44 (22 minutes)

The ever-growing ecosystem of beyond standard model (BSM) calculations and parametrizations has motivated the development of systematic methods for making quantitative cross-comparisons over the wide range of possible models, especially with controllable uncertainties. In this talk, we highlight how the language of uncertainty quantification (UQ) furnishes useful metrics for assessing statistical overlaps and discrepancies among BSM and related models. We leverage recent machine learning (ML) developments in evidential deep learning (EDL) for UQ to separate data (aleatoric) and knowledge (epistemic) uncertainties in a model-discrimination setting. We construct several potentially BSM-motivated scenarios for the anomalous electroweak interaction (AEWI) of neutrinos with nucleons in deep inelastic scattering (νDIS) and quantitatively map these as a demonstration alongside Monte Carlo replicas of the CT18 PDFs used to calculate the $\Delta\chi^2$ statistic for a typical multi-GeV νDIS experiment, CDHSW. This approach can help facilitate efficient BSM model exploration and exclusion for future New Physics searches while complementing a suite of related ML-based PDF analysis tools, which we also highlight.

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Session Classification: WG1/3: Joint session (WG1/3: Structure Functions and Parton Densities + Electroweak Physics and Beyond the Standard Model)

Track Classification: Electroweak Physics and Beyond the Standard Model