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SimuNET: an open-source tool for the simultaneous fit of PDFs and SMEFT coefficients

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I present a new methodology that can simultaneously fit the Parton Distribution Functions (PDFs) of the proton alongside other parameters that determine the theory predictions. The framework is particularly suited for the study of joint PDF-SMEFT interpretations, where the effects of heavy new physics (NP) are encoded in higher-dimensional operators which alter the interactions among SM particles.
SimuNET is an extension of the NNPDF4.0 methodology, characterised by a flexible neural network parameterisation that allows for extracting proton PDFs and associated uncertainties from a broad data collection. Within this framework, adding an extra layer allows for further parametric dependence in the theory predictions, enabling the simultaneous fit of SMEFT coefficients.
SimuNET can carry out state-of-the-art SMEFT analyses of Higgs, top, Drell-Yan, and electroweak data, allowing for the study of their interplay with the PDFs. It is equipped with various post-fit analysis tools, extending the inherited PDF functionalities with a toolbox for SMEFT interpretations. Further, it provides the user with a functionality designed to determine whether global PDF fits might inadvertently 'fit away' NP in the high-energy tails of the distributions.

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