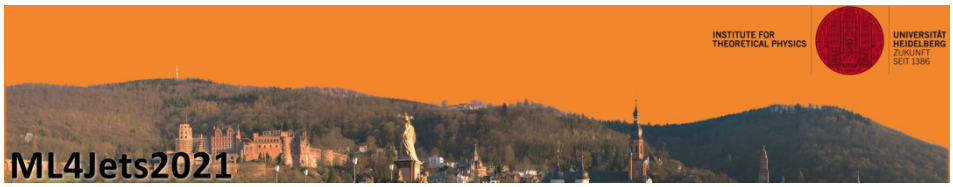

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White Box AI for parton shower development

Wednesday 7 July 2021 16:40 (20 minutes)

We present an implementation of an explainable and physics-aware machine learning model capable of inferring the underlying physics of high-energy particle collisions using the information encoded in the energy-momentum four-vectors of the final state particles. We demonstrate the proof-of-concept of our White Box AI approach using a Generative Adversarial Network (GAN) which learns from a DGLAP-based parton shower Monte Carlo event generator. Our approach leads to a network that is able to learn not only the final distribution of particles, but also the underlying parton branching mechanism, i.e. the Altarelli-Parisi splitting function, the ordering variable of the shower, and the scaling behavior. While the current work is focused on perturbative physics of the parton shower, we foresee a broad range of applications of our framework to areas that are currently difficult to address from first principles in QCD. Examples include nonperturbative and collective effects, factorization breaking and the modification of the parton shower in heavy-ion, and electron-nucleus collisions.

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