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Particle Transformer with built-in IRC safety

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Top-performing jet networks often compromise infrared and collinear (IRC) safety, leading to a dilemma between pursuing high experimental performance and good theoretical interpretability. In this talk, we present an innovative modification of the classic Transformer self-attention block (whose token is per-particle input) to ensure full IRC safety. By integrating this recipe into Particle Transformer (ParT), we create a version of ParT with built-in IRC safety, which has a marginal performance trade-off but outperforms all existing IRC-safe and even many IRC-unsafe networks. This method can be adapted for various jet Transformer networks which are commonly considered state-of-the-art in multiple fields, hence providing a promising solution for the experimental-theoretical dilemma.

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