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Can You Hear the Shape of a Jet?

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The identification of interesting substructures within jets is an important tool to search for new physics and probe the Standard Model. In this paper, we present `\textsc{SHAPER}`, a general framework for defining computing shape-based observables, which generalizes the N -jettiness from point clusters to any extended shape. This is accomplished by minimizing the p -Wasserstein metric between events and parameterized manifolds of energy flows representing idealized shapes, implemented using the dual-potential Sinkhorn approximation for efficient minimization. We show how the geometric language of observables as manifolds can be used to easily define novel event and jet-substructure observables with built-in IRC safety that are useful for physics analyses. We then demonstrate the `\textsc{SHAPER}` framework by performing an example jet substructure analysis using these new shape-based observables.

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