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Giving events a new shape : measurements of multijet event isotropy at ATLAS using optimal transport

Friday 10 November 2023 09:00 (15 minutes)

A measurement of novel event shapes quantifying the isotropy of collider events is presented, made using 140 fb^{-1} of proton-proton collisions with $\sqrt{s}=13 \text{ TeV}$ centre-of-mass energy recorded with the ATLAS detector at CERN's Large Hadron Collider. These event shapes are defined as the Energy-Mover's Distance between collider events and isotropic reference geometries, evaluated by solving optimal transport problems. Isotropic references with cylindrical and circular symmetries are studied, to probe the symmetries of interest at hadron colliders. The novel event-shape observables defined in this way are infrared- and collinear-safe, have improved dynamic range and have greater sensitivity to isotropic radiation patterns than other event shapes.

In this talk, we present the ATLAS measurement and some additional variations, applications and interpretations of the event isotropy. We explore how the observable can be altered, e.g. by varying the distance metric, the reference topology, the underlying geometry, etc., to be more or less sensitive to features of the event. With these studies, one can define event shapes that improve their discrimination power in future searches for rare SM processes or BSM phenomena.

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Session Classification: Results, Observables & Techniques