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Understanding Jet Charge

The jet charge is an old observable that has proven uniquely useful for discrimination of jets initiated by different flavors of light quarks, for example. In this Letter, we propose an approach to understanding the jet charge by establishing simple, robust assumptions that hold to good approximation non-perturbatively, such as isospin conservation and large particle multiplicity in the jets, forgoing any attempt at a perturbative analysis. From these assumptions, the jet charge distribution with fixed particle multiplicity takes the form of a Gaussian by the central limit theorem and whose mean and variance are related to fractional-power moments of single particle energy distributions. These results make several concrete predictions for the scaling of the jet charge with the multiplicity, explaining many of the results already in the literature, and new results we validate in Monte Carlo simulation.

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