

Entropy of Jets

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Scattering processes often inevitably include the production of infra-red states, which are highly correlated with the hard scattering event, and decohere the hard states. The hard reduced density matrix (tracing out infra-red states) has a non-zero entropy. We describe this entropy for an asymptotically-free gauge theory by separating the Hilbert space into hard and infra-red states, and calculate it in a leading-logarithmic approximation for jets. We find that the entropy increases when the resolution scales defining the hard radiation are lowered, that this entropy is related to the subjet multiplicity, and explore connections to using jet images for machine learning, and the forward-scattering density matrix of partons in a nucleon probed in deep-inelastic scattering.

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