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Quantum Information Science in Proton-Proton Collisions at the Energy Frontier

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The observed thermalization in particle production at colliders, usually inferred from the presence of the exponential component in the transverse momentum distributions of produced particles and the thermal abundances of the hadron yields, is proposed as due to quantum entanglement inside the proton wave functions in the proton-proton collisions. This presentation will show our analysis results of the transverse momentum distributions, and conclusions in the following proton-proton collision processes, all at 13 TeV collision energy: (i) inclusive inelastic pp collisions; (ii) single- and double-diffractive Drell-Yan production $pp \rightarrow \mu+\mu-X$; and (iii) Higgs boson production. Given our results, the wealth of new LHC data, and ongoing efforts, this is shown to be an exciting research area at the interface of QIS and HEP.

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