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Universality of particle production and energy balance in hadronic and nuclear collisions

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Universality of multihadron production in AA and hadronic interactions is studied using collision energy and centrality dependencies of the measured charged particle mean multiplicity. The study uses the framework of an effective-energy approach combining the constituent quark picture and Landau relativistic hydrodynamics and relating hadronic and nuclear collisions. The energy dependence of the multiplicity and the pseudorapidity density of head-on AA collisions are well reproduced. The multiplicity centrality dependence reveals a new scaling between the measured and estimated pseudorapidity spectra. Using this scaling, called the energy balanced limiting fragmentation scaling, all centrality spectra are described. This elucidates the difference in centrality dependence of multiplicity at RHIC and LHC and also the RHIC midrapidity density vs multiplicity. A new regime in AA collisions is indicated at ~1 TeV. Predictions are made for the multiplicities in pp and AA collisions at LHC.

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