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Search for new symmetries of hadron production in high energy collisions of protons and nuclei

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The status of z-scaling theory is reviewed. Basic physical principles such as self-similarity, locality, and fractality are discussed. The microscopic scenario of interactions of hadrons and nuclei at a constituent level in terms of dimensionless variables is studied.
The structure of the colliding objects and fragmentation process in final state is described by fractal dimensions δ_1, δ_2 and ϵ_a, ϵ_b, respectively. The fractal dimensions and the model parameter c interpreted as a specific heat of the produced medium are found from the scaling behavior of the dimensionless function $\psi(z)$, which depends on a self-similarity variable~z. The scaling variable z is given in terms of the momentum fractions x_1, x_2, y_a, and y_b that define a selected constituent sub-processes. The principle of maximal entropy is used to determine the momentum
fractions taking into account the momentum conservation for the selected binary interaction. Applicability of the z-scaling approach for the description of polarization processes is illustrated. The equivalence of the minimal resolution principle with respect to the constituent sub-processes and the maximal fractal entropy $S_{\delta,\epsilon}$ is shown. The principle of maximum entropy together with the assumption of the fractal self-similarity of hadron structure and fragmentation processes leads to the preservation of a scale-dependent quantity - fractal cumulativity, characterizing hadron interactions at a constituent level. The fractal cumulativity is a property of a fractal-like object (or fractal-like process) with fractal dimension D to form a "structural aggregate" with certain degree of local compactness which carries its momentum fraction ζ.
The conservation law for the fractal cumulativity is formulated.
The crossing symmetry for the part of the entropy $S_{\delta,\epsilon}$ dependent only on the fractal dimensions in high resolution limit is discussed.

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