Z-scaling, fractality, and principles of relativity in relativistic collisions of hadrons and nuclei

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Abstract

The formation length of particles produced in the relativistic collisions of hadrons and nuclei has relevance to fundamental principles of physics at small interaction distances. The relation is phenomenologically expressed by a z-scaling observed in the differential cross sections for the inclusive reactions at high energies. The scaling variable reflects the length of the elementary particle trajectories in terms of a fractal measure. Characterizing the fractal approach, we demonstrate the relativity principles in space-time with broken isotropy. We derive relativistic transformations accounting for the asymmetry of space-time induced in the interactions by various parton fractal structures of hadrons and nuclei.