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On the origin of supercompressible states of the traffic flow

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Studying recent empirical traffic data, we show surprising statistical anomalies in the traffic microstructure that can not be explained by current scientific approaches used in physics of traffic. We introduce the concept of Balanced Particle Systems as an effective mathematical instrument for a description of statistical properties of vehicular microstructure, quantify these anomalies mathematically and explain their cause. Concretely we deal with the specific states of traffic flow on a two-lane freeway, in which statistical fluctuations of microscopic quantities are significantly higher than in systems with absolutely random events (Poisson systems). Finally, we show that these super-random states are detected specifically in the fast lane at free-flow traffic quantities (up to 25 vehicles per kilometer).

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