

Abstract Submitted
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On statistical conservation laws in smooth chaotic velocity fields¹

SIIM AINSAAR, Institute of Physics, University of Tartu, JAAN KALDA, MIHKEL KREE, Department of Cybernetics, Tallinn University of Technology — It is known that at small scales, the separation of Lagrangian tracer particles in a d -dimensional incompressible isotropic turbulent flow obeys a statistical conservation law $\langle r^{-d} \rangle = \text{const}$. We present a novel simple geometric proof of this fact, and generalize it to the case of compressible velocity fields. This law constrains the entropy function and thus the non-gaussianity of the probability distribution of the logarithm of particle separation. This suggests an approximate way to minimally generalize the Fokker-Planck equation describing the evolution of this probability distribution, in order to account for the effects of finite correlation time. Numerical simulations verify the validity of this approach.

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