Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

Supersymmetry Breaking and Hydrodynamic Turbulence BEN ISRAELI, Princeton University, IGOR OVCHINNIKOV, Thermo Fisher Scientific — Supersymmetry has been previously established to be pertinent to all stochastic and deterministic differential equations (SDEs). This supersymmetry represents the preservation of continuity of the phase space by continuous-time evolution and, from the technical point of view, is the De Rham operator (or exterior derivative) that commutes with any SDE-defined stochastic evolution operator. In its turn, the spontaneous breakdown of this supersymmetry is associated with the emergence of the exponentially growing eigenstates that signal the onset of chaos and underlie the long range dynamical behavior in the spirit of the Goldstone theorem. In this work, we approach the problem of hydrodynamical turbulence and the associated power law statistics within this supersymmetric picture of continuous-time dynamics and aim to describe these phenomena using path integral representation of hydrodynamics. More specifically, the work consists of analysis of correlators that may unambiguously demonstrate that the theoretical essence of turbulence is indeed spontaneous supersymmetry breaking.

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Date submitted: 29 Jun 2020 Electronic form version 1.4