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Decaying Turbulence as a fractal curve

Wednesday, July 19, 2023 11:00 AM (25 minutes)

We develop a quantitative microscopic theory of decaying Turbulence by studying the dimensional reduction of the Navier-Stokes loop equation for the velocity circulation. We have found an infinite dimensional manifold of solutions of the Navier-Stokes loop equation\cite{M93, M23PR} for the Wilson loop in decaying Turbulence in arbitrary dimension $d > 2$. This family of solutions corresponds to a fractal curve in complex space $\mathbb{C}^d$, described by an algebraic equation between consecutive positions plus a nonlinear periodicity condition.
We derive the constrained SDE for the evolution of the fractal curve at a fixed moment of physical time as a function of an auxiliary stochastic time. We expect this stochastic process to cover our fixed manifold of the solutions of the decaying Turbulence.
The energy density of the fluid decays as $\mathcal{E}_0/t$, where $\mathcal{E}_0$ is an initial dissipation rate.
Presumably, we have found a new phase of extreme Turbulence yet to be observed in real or numerical experiments.

Is this abstract from experiment?

No

Name of experiment and experimental site

N/A

Is the speaker for that presentation defined?

Yes

Details

N/A

Internet talk

Yes

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