4CS19-2019-000024
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Abstract for an Invited Paper
for the 4CS19 Meeting of
the American Physical Society

Quantum Turbulent Structure in Light[1]

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A random superposition of plane waves is known to be threaded with vortex line singularities which form complicated tangles and obey strict topological rules. In this work, we use both numerical simulations of random waves and experiments on laser speckle to observe and characterize the dynamics of the vortex tangles. We find that the velocity statistics of the vortices in random waves match those of turbulent quantum fluids such as superfluid helium and atomic Bose-Einstein condensates[2]. These statistics are shown to be independent of system scale. These results raise deep questions about the role of nonlinearity in the structure of turbulence and the general nature of quantum chaos. Co-authors: Samuel Alperin, Abigail Grotelueschen, Andrew Voitiv, Jasmine Andersen, William Holtzmann, and Leah Huzjak, Department of Physics Astronomy, University of Denver, and Mark Lusk, Department of Physics, Colorado School of Mines

[1]The authors acknowledge support from the NSF and the W. M. Keck Foundation.
[2]Physical Review Letters 122, 044301 (2019)