

Abstract Submitted  
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**Network Structure of  
Two-Dimensional Homogeneous Turbulence<sup>1</sup>** KUNIHICO TAIRA, ADITYA  
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— The network structure of two-dimensional incompressible homogeneous turbulence is characterized by highlighting the vortical interactions in the flow field. By analyzing the degree distribution of the turbulence network, it is observed that turbulence has an underlying scale-free network that describes how vortical structures are interconnected. In the network-theoretic framework, we can identify strong vortices that serve as hubs that are strongly connected to other vortical hubs. Smaller and weaker eddies are found to be predominantly influenced by the neighboring hubs. These observations complement previous knowledge of turbulence based on vortex dynamics. The time evolution of the fluid flow network shows that the scale-free property is achieved when turbulence is sustained but is not observed when the flow reaches a laminar regime through dissipation. The finding that turbulence has a scale-free interaction network enables us to identify the type of perturbations that turbulence is resilient against. These insights from network analysis enable us to examine how the behavior of turbulent flows can be modified.

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