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A Kinetic Description of Turbulent Velocity and Vorticity Distributions MICHAEL WILCZEK, ANTON DAITCHE, RUDOLF FRIEDRICH, Institute for Theoretical Physics, University of Muenster — The single-point statistics of velocity and vorticity in fully developed homogeneous and isotropic turbulence displays very distinct features. While the former is known to exhibit nearly Gaussian behavior, the latter develops strong non-Gaussian tails, mirroring the differing spatial structure of both fields. We analyze these statistics within the framework of the Lundgren-Monin-Novikov hierarchy, which allows to derive kinetic equations for the evolution of the probability functions from first principles. The unclosed terms are estimated with the help direct numerical simulations. The results provide insight into the connection between basic dynamical flow structures such as vortex tubes and non-Gaussian statistics and characterize the influence of the different field topologies on the single-point statistics.

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