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On the Inertial Range Scaling in the High-R_λ Limit CHRISTIAN KUECHLER, Max Planck Institute for Dynamics and Self-Organization, Goettingen, Germany, GREGORY P. BEWLEY, Cornell University, Ithaca, USA, EBERHARD BODENSCHATZ, Max Planck Institute for Dynamics and Self-Organization, Goettingen, Germany — We investigate in a decaying laboratory flow the universal scaling laws Kolmogorov predicted in 1941 to emerge in the limit of infinite R_λ. In the past it has been found that this limit requires extreme R_λ, which are difficult to create in a well-controlled turbulent flow. The Variable Density Turbulence Tunnel (Bodenschatz et al., 2014) is the first wind tunnel capable of producing $R_\lambda > 5000$ and fully resolved inertial scales. It combines the low kinematic viscosity of pressurized SF6 and a unique mosaic-like active grid with individually controllable tiles (Griffin et al., 2019). To resolve the smallest scales present in the flow, we use Nanoscale Thermal Anemometry Probes developed and generously provided by Princeton University (e.g. Bailey et al. (2009), Vallikivi et al. (2014)). We present results that the energy spectrum and structure functions differ from conventional scaling laws of isotropic turbulence when studying the logarithmic derivatives of these statistics. However, these local scaling exponents approach a universal form when $R_\lambda > 2000$. We show that those results are well-described by the generalized self-similar spectrum of decaying turbulence introduced by Yang et al. (2018).

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