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Approach to the Kolmogorov Inertial Range in Turbulent Pipe Flow[1] SPENCER ZIMMERMAN, Univ of Melbourne, ROBERT ANTONIA, LYAZID DJENIDI, Univ of Newcastle, JIMMY PHILIP, JOSEPH KLEWICKI, Univ of Melbourne — Kolmogorov's famous 4/5 (or, equivalently, 4/3) law follows from the notion that large scale separation (as represented by high Reynolds number) will eventually lead to the emergence of an "inertial range" provided the effects of viscosity and the large-scale anisotopy are negligible. Within this range, the rate of interscale energy transfer is dictated by the mean dissipation rate of kinetic energy alone. Unlike other predicted features of the inertial range, such as the 2/3 or -5/3 laws, the emergence of the 4/5 (or 4/3) law may be characterized using a scale-by-scale energy budget equation derivable directly from the Navier-Stokes equations. In this presentation, we describe the evolution of the terms in this equation for a turbulent pipe flow and the resulting approach to the inertial range. To do so, we exploit several previously published single- and multi-component velocity measurements spanning a wide range of Reynolds numbers. It is found that the approach to the inertial range is slow at the centerline of the pipe, primarily due to the slow evolution with the Reynolds number of the turbulent diffusion related large scale term in the scale-by-scale energy budget.

[1]Australian Research Council

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