The connection between the Navier-Stokes equations and Kolmogorov's theory for fully developed turbulence

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In the early 1940s, Kolmogorov found explicit estimates for some important physical quantities associated with very turbulent fluid flows. These estimates were obtained by an elementary dimensional argument subject to a few pertinent physical assumptions. During the past 15 years several groups of researchers have attempted to derive rigorously Kolmogorov's estimates from the properties of the Navier-Stokes equations. In this lecture we will discuss both Kolmogorov's theory and its rigorous partial confirmation arrived at in collaboration with O.Manley, R.Temam and associates.