Romanticized since Leonardo da Vinci compared the motion of a water jet rapidly falling into a pool to the curls and waves of long, gorgeous hair, turbulence is a field blessed with stunning images, elegant mathematics, intellectually fascinating physics, and vitally important applications. Its significance at the human, geologic, and cosmologic scales can only be understated. Turbulent transport in plasma sustains the nuclear fusion process that keeps the stars alive; the vigorous turbulent mixing in the atmosphere keeps cities from suffocating under their own human-produced carbon dioxide; and a turbulent boundary layer allows an airfoil to generate more lift at larger angles of attack than a corresponding laminar flow. The darker facet of turbulence is its extreme complexity, sending chills down the spines of students and professionals alike. Turbulence is also mostly responsible for the high fuel consumption of all air, land, and sea transportation systems.

In this talk, I shall take a quick passage through five centuries of turbulence research, highlighting major milestones. The more recent cornerstones include the Kolmogorov’s equilibrium theory of turbulence spectrum, the universal logarithmic law of wall-bounded flows, and the proliferation of direct numerical simulations. I shall discuss recent fault lines in all three major achievements, but also point to novel remedies as well as to a few contemporary accomplishments.
Mohamed Gad-el-Hak received his BS (summa cum laude) in mechanical engineering from Ain Shams University in 1966 and his PhD in fluid mechanics from the Johns Hopkins University in 1973. Gad-el-Hak has since taught and conducted research at the University of Southern California, University of Virginia, University of Notre Dame, Institut National Polytechnique de Grenoble, Université de Poitiers, Friedrich-Alexander-Universität Erlangen-Nürnberg, Technische Universität München and Technische Universität Berlin, and has lectured extensively at seminars in the United States and overseas.

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