Abstract Submitted
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Phase transition to turbulence in a pipe[1] NIGEL GOLDENFELD[2], University of Illinois at Urbana-Champaign — Leo Kadanoff taught us much about phase transitions, turbulence and collective behavior. Here I explore the transition to turbulence in a pipe, showing how a collective mode determines the universality class. Near the transition, turbulent puffs decay either directly or through splitting, with characteristic time-scales that exhibit a super-exponential dependence on Reynolds number. Direct numerical simulations reveal that a collective mode, a so-called zonal flow emerges at large scales, activated by anisotropic turbulent fluctuations, as represented by Reynolds stress. This zonal flow imposes a shear on the turbulent fluctuations that tends to suppress their anisotropy, leading to a Landau theory of predator-prey type, in the directed percolation universality class. Stochastic simulations of this model reproduce the functional form and phenomenology of pipe flow experiments. Talk based on work performed with Hong-Yan Shih and Tsung-Lin Hsieh.

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[2]Kadanoff Session

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