Roughness induced criticality in two and three dimensional turbulent pipe flows[1] NIGEL GOLDENFELD, NICHOLAS GUTTENBERG, University of Illinois at Urbana-Champaign — Using an analogy with critical phenomena, we show that the data for the friction factor as a function of Reynolds number for rough turbulent three-dimensional pipe flows can be collapsed onto a single universal curve. Using momentum flux scaling arguments [1] taking into account the inverse and enstropy cascades, we calculate the scaling function for two- dimensional turbulent pipe flows, in particular the analogues of the Blasius and Strickler regimes. The roughness-induced criticality empirically obtained here hints at a deeper role of boundary roughness in understanding the scaling of turbulent flows.

[1] G. Gioia and Pinaki Chakraborty, "Turbulent friction in rough pipes and the energy spectrum of the phenomenological theory." March 17, 2005. Preprint.

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