SPECIAL TRANSPORT THEORY SEMINAR

Roughness-induced criticality and the statistical mechanics of turbulence in pipes and soap films

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2:30-3:30 pm
The Lewis Room, 66-360

Abstract

Are fluid turbulence and critical phenomena analogous to one another? In this talk, I explain that this connection may be deeper than has been previously thought. Indeed, I argue that one can use these insights to understand turbulence, in an attempt to emulate the pattern of discovery which led to the solution of the phase transition problem. I show that these ideas lead to the prediction of a novel scaling law --- a manifestation of what I term roughness-induced criticality --- that has been verified by analyzing experimental data on turbulent pipe flows, taken by Nikuradze in 1933. I review how the friction experienced by turbulent fluids can be captured quantitatively as a function of flow velocity and wall-roughness, by momentum-transfer arguments due to Gioia and Chakraborty, and describe how this theory and the roughness-induced criticality theory are currently being tested by direct numerical simulations and experiments on two-dimensional turbulent flows in soap films.

Hosted by Prof. Martin Bazant, Department of Chemical Engineering
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