MSS-Seminar

Wednesday, July. 3rd, 15:30, Nägelsbachstr. 49b

MSS

Phase Transition at the Onset of Turbulence

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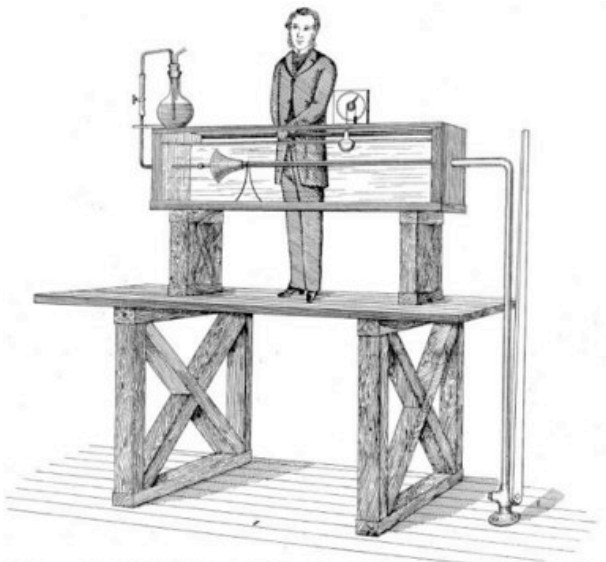
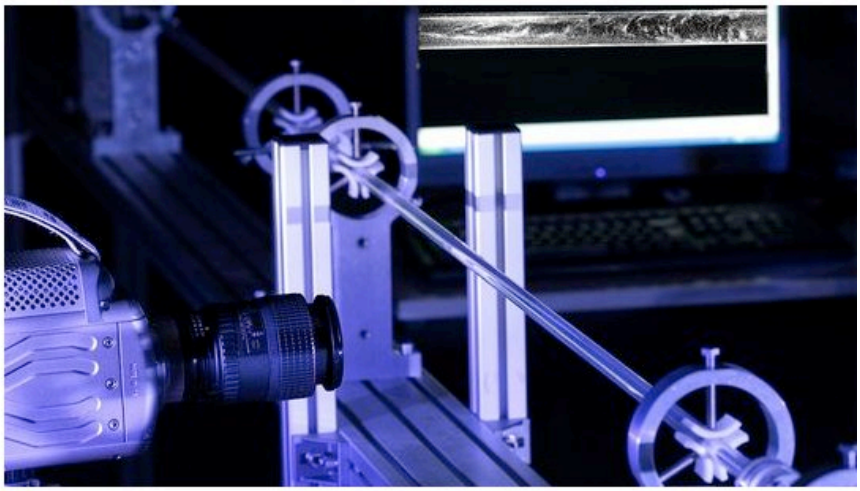


O. Reynolds, Philos. Trans. R. Soc. London Ser. A 174, 935 (1883)



In the 19th century Osborne Reynolds asked the seemingly simple question, when the flow in a pipe would be turbulent. While his investigations lead to the introduction of the Reynolds number Re [1], his original attempt to determine the transitional Re has occupied researchers for more than 120 years.

In this talk I will highlight theoretical and experimental difficulties of the transition to turbulence in pipe flow and how they have been finally overcome. The critical Reynolds number for the onset of turbulence is determined experimentally to Re=2040 +/- 10 and the transition placed in the broader context of non-equilibrium phase transitions [2].

In the second part of this talk I will challenge the interpretation of previous investigations of a phase transition in a flow between two shearing plates [3, 4]. Our measurements in a new high-precision experiment [5] with a large system size, which allow for a statistical analysis close to the critical point, indicate that the transition is of second order instead of first order as previously reported [3,4].

[1] O. Reynolds, Proc. Roy. Soc. London, Ser. A 35, 84 (1883).
[2] K. Avila, D. Moxey, A. de Lozar, M. Avila, D. Barkley, and B. Hof, Science 333, 192 (2011)
[3] S. Bottin, and H. Chate, Euro. Phys. J. B 6, 143 (1998)
[4] Y. Duguet, P. Schlatter, and D.S. Henningson, J. Fluid Mech. 650, 119 (2010)
[5] K. Avila, and B. Hof, Rev. Sci. Instr. 84, 065106 (2013)