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Two scenarios for dynamics of perturbations in pipe Poiseuille flow

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Two experiments on perturbations in circular pipe flows and their possible theoretical interpretations are discussed to illustrate complexity of the problem. The experimental data by A. Kaskel (1961) are discussed within the framework of spatial transient growth theory, and we argue that the phenomenon of transient growth was observed in the pipe-flow experiments. Another experiment (Eliahou et al, 1998) illustrates how weak streamwise vortices provide instability of the secondary disturbances which, in turn, amplify the steady vertical structures. The latter is consistent with the self-sustaining process scenario. These examples, and more recent DNS and experimental studies represent typical controversies that arise in the study of complex systems.

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