

Physical Colloquium

„Non-Equilibrium Turbulence in the Post-Kolmogorovean era – A Combined Empirical-Theoretical Approach“

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Colloquium on

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Room No. W02 1-148

Turbulence remains one of the most important unsolved problems in classical physics. As in many other branches of physics, equilibrium descriptions are prevalent, yet it is the non-equilibrium states that dominate nature and engineering and often govern the most critical dynamics. The classical framework – shaped by Richardson, Kolmogorov, and Batchelor and commonly referred to as K41 – rests on assumptions of local equilibrium. While this produces reliable predictions under near-equilibrium conditions, it fails to capture flows that evolve strongly in space and time, where memory effects, inhomogeneities, and non-local interactions dominate.

In this talk, I will present recent progress towards a post-Kolmogorov understanding of turbulence, based on a combined empirical-theoretical program. We are formulating the framework for a theory of non-equilibrium turbulence, designed to capture the dynamics beyond K41. This theoretical framework is being directly validated through extensive state-of-the-art experiments, enabling us to uncover the mechanisms that govern energy and momentum transfer in evolving flows. I will conclude by outlining how this approach paves the way for improved models of turbulence and opens new perspectives for tackling one of physics' enduring frontiers.

Host: Prof. Dr. Martin Kühn

