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Energy Cascade in Quantum Gases[1] X. Y. YIN, TIN-LUN HO, Ohio State Univ - Columbus — Energy cascade is ubiquitous in systems far from equilibrium. Facilitated by particle interactions and external forces, it can lead to highly complex phenomena like fully developed turbulence, characterized by power law velocity correlation functions. Yet despite decades of research, how these power laws emerge from first principle remains unclear. Recently, experiments show that when a Bose condensate is subjected to periodic shaking, its momentum distribution exhibits a power law behavior. The flexibility of cold atom experiments has provided new opportunities to explore the emergence of these power laws, and to disentangle different sources of energy cascade. Here, we point out that recent experiments in cold atoms imply that classical turbulence is part of a larger family of scale invariant phenomena that include ideal gases. Moreover, the property of the entire family is contained in the structure of its Floquet states. For ideal gases, we show analytically that its momentum distribution acquires a $1/q^2$ tail in each dimension when it is shaken periodically.

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Xiangyu Yin
Ohio State Univ - Columbus

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