Evolution of Complexity from the Nano- to the Macroscale

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Understanding the origins of complexity in strongly interacting systems is one of the most fascinating and important problems in condensed matter physics. Experimental advances over the last decade have opened a new bottom-up approach to this intriguing problem by creating nano-/mesoscopic copies of strongly correlated macroscopic systems, thus allowing one to study the emergence of complex behavior at the nanoscale, and to investigate its evolution across the meso- to the macroscale.

In this talk, I review three systems that exemplify this successful approach: Kondo droplets and heavy fermion materials, graphene, and biological photosynthetic complexes. In particular, I show how the interplay between geometry, dephasing, and interactions gives rise to the emergence of complex behavior at the nanoscale, both in and out-of-equilibrium.