清华大学高等研究院

Institute for Advanced Study, Tsinghua University

学术报告

Title: **Large-N Approach to Gapless SPT**

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Venue: **Conference Hall 322, Science Building, Tsinghua University**

Abstract

Significant progress in the study of classical and quantum phase transitions involving symmetry breaking has been achieved over the past decades. Now, a new set of questions have been thrown up by the discovery of symmetry protected topological states (SPTs), that generalize the notion of topological insulators. Here, symmetries and a bulk gap stabilize unusual modes at surfaces or at topological defects. What is the fate of these protected modes at a quantum critical point, when the protecting symmetries are on the verge of being broken? This interplay of topology and criticality is expected to be extremely rich, given that it incorporates both the bulk dynamics of critical points described by nontrivial conformal field theories and the intrinsically quantum aspects of SPT physics. Combining these two disparate ingredients in an analytically tractable framework is challenging. Here, we make progress towards this goal by studying the simplest nontrivial model - that of a 0+1 dimensional topological mode, coupled to a 2+1D critical bulk - using the large-N technique. We introduce a series of models that can be solved within the large-N approximation which, as a consequence of topology, demonstrate intermediate coupling fixed points. We compare our results to previous numerical simulations and find good agreement. We also point out some intriguing connections to the physics of Sachdev-Ye-Kitaev (SYK) models, in particular we show that a Luttinger theorem derived for the complex SYK models, that relates the charge density to particle-hole asymmetry, also holds in our setting. These results should help open up the analytical study of the rich interplay between SPT physics and quantum criticality.