Physics Seminar: Ryan Lanzetta
Wednesday, January 21·2:00 – 3:00pm
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Title: Toward an upper bound on the thermal mass gap at criticality

Abstract: An intrinsic quantity characterizing a scale-invariant quantum field theory (SFT) is the mass gap it acquires upon being compactified on a circle, alternatively referred to as the "thermal mass". By scale-invariance, this is a pure number in units of the inverse circumference of the circle. In 2d conformal field theory (CFT), a theory-independent upper bound on the thermal mass follows straightforwardly from unitarity, locality, and conformality. In this talk I will discuss the possibility of a numerical bootstrap upper bound on the thermal mass for SFTs in 3d. I will propose a bootstrap framework to study the thermal free energy of circle-compactified 3d SFTs, which will invoke two constraints: an analog of modular invariance, and consistency with a formula expressing the thermal free energy in terms of the S matrix due to Dashen, Ma, and Bernstein. Accounting for the implications of the latter will motivate a positivity assumption that facilitates the use of numerical bootstrap techniques, which roughly restricts the analysis to theories with attractive interactions. I will show that, within the class of theories obeying the bootstrap constraints, there is a theory-independent upper bound on the thermal mass.