Higgs mode and conductivity in the vicinity of a quantum critical point

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Abstract

Relativistic quantum field theories with O(N) symmetries play an important role in describing the low-energy sector of several condensed matter systems in the vicinity of a quantum phase transition. Using non perturbative RG techniques, we study zero temperature dynamical properties of O(N) field theory in two space dimensions.
We investigate the excitation spectrum of the model and show that there is a well-defined "Higgs" amplitude mode in the ordered phase near criticality for N = 2 and 3. In addition, we compute the conductivity at low frequencies and determine its universal properties. Based on our results, we conjecture that one of the components of the conductivity in the ordered phase is a "superuniversal" number and depends neither on the distance to the critical point nor on N.

References:
F. Rose, F. Léonard, and N. Dupuis, "Higgs amplitude mode in the vicinity of a (2 + 1)-dimensional quantum critical point: A nonperturbative renormalization-group approach," Phys. Rev. B **91**, 224501 (2015), arXiv:1503.08688.

F. Rose and N. Dupuis, "Nonperturbative functional renormalization-group approach to transport in the vicinity of a (2+1)-dimensional O(N)-symmetric quantum critical point," arXiv:1610.06476.

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