MAR13-2013-020946

Abstract for an Invited Paper
for the MAR13 Meeting of
the American Physical Society

Higgs Excitations in Dimer Antiferromagnets

CHRISTIAN RÜEGG, Paul Scherrer Institute

In three-dimensional dimer antiferromagnets a generic quantum critical point (QCP) separates a quantum-disordered ground state with a spin gap from a phase with long-range antiferromagnetic order and finite ordering temperature. While this QCP and related phases have been studied intensely in theoretical and numerical work using among other methods bond-operators and quantum Monte-Carlo, real materials in which they can be explored experimentally are rare. Structurally dimerised antiferromagnets are located on the disordered or ordered side of the QCP and application of pressure offers a way to control the ration of exchange interactions in the material across a critical value, if the compressibility and pressure dependence of the exchange are favourable. In $TlCuCl_3$ this QCP was realised for the first time and was studied in great detail by neutron scattering. These experiments provide unprecedented insights into the effects of thermal and quantum fluctuations, and of the elementary excitations near QCPs. A unique phenomena is the emergence of longitudinal modes near the QCP, which are the Higgs exceptions in dimer antiferromagnets proposed by S. Sachdev and coworkers. These Higgs exceptions follow precisely scaling predications and are involved in both the quantum and thermal melting of order in such systems.