Disorder in quantum magnets: from Random Singlet to Bose Glass.

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Traditionally, Hamiltonian disorder in spin systems was studied in the context of its effect on magnetic long-range ordering. Hence the interest in spin glasses, percollation and random-field effects. However, in a vast class of "quantum" magnets, ordering is destroyed by zero-point quantum spin fluctuations even in the unperturbed case. In these materials all spin correlations are dynamic. Therefore, the effect of Hamiltonian disorder is to be discussed in terms of its influence on *excitations*. Theory predicts a range of phenomena, from reduced quasiparticle lifetimes, to Andreson localization of magnons, to universal scaling of the dynamic spin correlation and transport functions. Particularly dramatic is the effect on spin systems that are either at a quantum critical point or can be brought to one by the application of an external magnetic field or pressure. In these "hypersensitive" cases, qualitatively new quantum phases are expected to emerge.

Realizations of disordered quantum magnets suitable for experimental investigation are recent and still few, but steady progress is being made. The elusive "Random Singlet" phase has been identified in the random-bond $S = 1/2$ chain system $BaCu_2SiGeO_7$. Evidence of the "magnon Bose Glass" was found in several metallorganic materials based on Cu-halogen networks with bond disorder. I shall review some of these studies, including thermodynamic, NMR, μ-SR and neutron scattering experiments, setting the stage for several contributed presentations and the Conference.