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We present results from quantum Monte Carlo studies on the effects of a magnetic impurity on the order parameter distribution in a two-dimensional host antiferromagnet. We find that for a weak coupling to the impurity spin, the staggered magnetization is enhanced throughout the lattice, whereas increasing the coupling between the host and the impurity spin restricts this enhancement to the close vicinity of the impurity, whereas on all other sites the staggered magnetization gets suppressed compared to the clean case. Approaching the limit of an infinite coupling between host and impurity, the system hence crosses over to the case of an embedded non-magnetic impurity site. We compare our results with previous findings, based on spin-wave and perturbation theory.

TT 8.10 Mon 16:30 H 0104

Numerical investigation of the quantum dimer model on a diamond lattice — •Olga Sikora[1], Frank Pollmann[1], Nic Shannon[2], Karlo Penc[3], and Peter Fulde[1] — [1]Max Planck Institute for the Physics of Complex Systems, Noethnitzer Str. 38, 01187 Dresden, Germany — [2]H.H. Wills Physics Laboratory, University of Bristol, Tyndall Avenue, Bristol BS8 1 TL, UK — [3]Research Institute for Solid State Physics and Optics, H-1525 Budapest, P.O.B. 49, Hungary

Quantum dimer models (QDMs) are of great interest in the study of systems with frustrated spin or charge degrees of freedom. On bipartite lattices these QDMs can be mapped onto a U(1)-gauge theory, with a liquid-like ground state and fractional excitations. However in two dimensions, these excitations are confined, except at the Rokhsar-Kivelson (RK) point, a quantum critical point occurring for one specific ratio of parameters. Recently, it has been suggested that in the QDM on a 3D diamond lattice, a U(1) liquid is not confined to a single point, but extends for a finite range of parameters bordering the RK point.

We have used Green's Function Monte Carlo (GFMC) and Variational Monte Carlo simulations to test this conjecture numerically. Our preliminary GFMC calculations suggest that the confining potential for fractional excitations vanishes in a large region of the parameter space, confirming the existence of an extended liquid phase.

15 min. break

TT 8.11 Mon 17:00 H 0104

Spectral functions of kagome lattice structures with charge degrees of freedom — •Aroon O'Brien, Frank Pollmann, and Peter Fulde — Max Planck Institute for the Physics of Complex Systems, Noethnitzer Str. 38, 01187 Dresden, Germany

Systems in which strong electronic interactions are frustrated can exhibit interesting physical effects. Two particularly well known frustrated lattices are the planar pyrochlore (checkerboard) lattice and the kagome lattice. For a model of spinless fermions on a checkerboard lattice, it has been demonstrated that fractional charges occur at certain filling factors [1]. A thorough study of this model has further shown that these fractional charges are linearly confined [2]. However, whether fractional charges are confined or deconfined at various fillings on the kagome lattice is not yet understood. We address this question through the numerical calculation of various properties of static and dynamic fractional charges at 1/3 and 1/6 filling, for a model of spinless fermions on the kagome lattice.

[1] P. Fulde, K.Penc, and N. Shannon, Annalen der Physik (Leipzig) **11**, 892 (2002)

[2] F. Pollmann and P. Fulde, EPL 75, 133 (2006)

TT 8.12 Mon 17:15 H 0104

Supersolid phase induced by correlated hopping in spin-1/2 frustrated quantum magnets — •Kai P. Schmidt[1], Julien Dorier[1], Andreas Laeuchli[2], and Frederic Mila[1] — [1]Institute of Theoretical Physics, Ecole Polytechnique Federale de Lausanne, CH-1015 Lausanne, Switzerland — [2]Institut Romand de Recherche Numerique en Physique des Materiaux (IRRMA), CH-1015 Lausanne, Switzerland

We show that correlated hopping of triplets, which is often the dominant source of kinetic energy in dimer-based frustrated quantum magnets, produces a remarkably strong tendency to form supersolid phases in a magnetic field. These phases are characterized by simultaneous modulation and ordering of the longitudinal and transverse magnetization respectively. Using Quantum Monte Carlo and a semiclassical approach for an effective hard-core boson model with nearest-neighbor repulsion on a square lattice, we prove in particular that a supersolid phase can exist even if the repulsion is not strong enough to stabilize an insulating phase at half-filling. Experimental implications for frustrated quantum antiferromagnets in a magnetic field at zero and finite temperature are discussed.

TT 8.13 Mon 17:30 H 0104

Spinon confinement and the Haldane gap in SU(n) spin chains: numerical studies — •Max Führinger[1], Stephan Rachel[1], Ronny Thomale[1], Peter Schmitteckert[1,2], and Martin Greiter[1] — [1]Institut für Theorie der Kondensierten Materie, Universität Karlsruhe, 76128 Karlsruhe — [2]Institut für Nanotechnologie, Forschungszentrum Karlsruhe, 76021 Karlsruhe

Recently, two of us [1] motivated a general set of rules which SU(n) spin chains exhibit spinon confinement and hence a Haldane gap in the spectrum. According to these rules, models of spin chains with SU(n) spins transforming under a representation corresponding to a Young tableau consisting of a number of boxes λ which is divisible by n, are gapped. If λ and n have no common divisor, the spin chain will support deconfined spinons and not exhibit a Haldane gap. If λ and n have a common divisor different from n, it will depend on the specifics of the model including the range of the interaction.

Here we present numerical evidence for these rules, obtained by exact diagonalization and DMRG, using the representations **3**, **6**, **8**, and **10** of SU(3) and the representations **4**, **6**, and **10** of SU(4). The numerical data obtained include the low energy spectra and results for bond and entanglement entropies. The entanglement entropy yields the central charge of the critical models as well.

[1] M. Greiter and S. Rachel, Phys. Rev. B **76**, 184441 (2007).

TT 8.14 Mon 17:45 H 0104

Field-dependent thermal transport in the Haldane chain compound NENP — •A. V. Sologubenko[1], T. Lorenz[1], J. A. Mydosh[1], and M. M. Turnbull[2] — [1]II. Physikalisches Institut, Universität zu Köln, 50937 Köln, Germany — [2]Carlson School of Chemistry and Department of Physics, Clark University, Worcester, MA 01610, USA

Properties of materials in the vicinity of quantum phase transitions have recently attracted considerable attention. Of particular interest are low-dimensional magnetic systems with transitions between various gapless and gapped states, induced by an external magnetic field. We present experiments on the magnetic field dependent thermal transport in the spin $S = 1$ chain material $Ni(C_2H_8N_2)_2NO_2(ClO_4)$ [NENP]. In NENP, the Haldane energy gap in the magnon excitation spectrum can be greatly reduced by applying an external magnetic field, but it remains finite at the critical field. The thermal conductivity is strongly affected by the field-induced changes in the magnon spectrum. It is possible to clearly distinguish the magnetic and the phononic contributions to the total heat conductivity and to successfully analyze the spin contribution in terms of a quasiparticle model. The mean free path of the spin excitations, evaluated from our data, is temperature-independent and large, which has important implications for the theory of transport in quantum spin systems.

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