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Spin Dimers: from BEC to Luttinger liquids[1]

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Localized spin systems, and in particular dimer systems, provide a fantastic laboratory to study the interplay between quantum effects and the interaction between excitations. Magnetic field and temperature allow an excellent control on the density of excitations and various very efficient probes such as neutrons and NMR are available. They can thus be used as "quantum simulators" to tackle with great success questions that one would normally search in itinerant interacting quantum systems. In particular they have provided excellent realizations of Bose-Einstein condensates [1,2]. This allowed not only to probe the properties of interacting bosons in a variety of dimensions but also to study in a controlled way additional effects such as disorder. If the dimensionality is reduced they also allow to test in a quantitative way Luttinger liquid physics [3,4,5]. I will discuss these various cases, and show that we have now good theoretical tools [6] to make quantitative comparisons with the experiments. Finally, how to go from this low dimensional case where the spins behave essentially as fermions, to the higher dimensional case where they behave as (essentially free) bosons, is a very challenging, and experimentally relevant issue.

[1] T. Giamarchi and A. Tsvelik, Phys. Rev. B **59** 11398 (1999).
[2] T. Giamarchi, C. Rüegg and O. Tchernyshyov, Nat. Phys. **4** 198 (2008).
[3] M. Klanjsek et al., Phys. Rev. Lett. **101** 137207 (2008).
[4] C. Rüegg et al., Phys. Rev. Lett. **101** 247202 (2008).
[5] B. Thielemann et al., Phys. Rev. B **79** 020408(R) (2009).
[6] P. Bouillot et al., arXiv:1009.0840 (2010).

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