Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Random Bonds Effects in the Spin-$\frac{1}{2}$ Heisenberg Antifferomagnet on the Square Lattice NICOLAS LAFLORENCIE, University of British Columbia, STEFAN WESSEL, ITP Universitat Stuttgard, ANDREAS LAEUCHLI, IRRMA EPFL Lausanne, HEIKO RIEGER, Universitat des Saarlandes — In one dimension, it is well know that the spin-$\frac{1}{2}$ Heisenberg antiferromagnetic (AF) chain, governed by $\mathcal{H}_{1d} = \sum_i J_i \vec{S}_i \cdot \vec{S}_{i+1}$, is unstable against any strength of bond randomness [1]. The *quasi*-long-range-ordered phase is indeed destroyed $\forall \langle J_i^2 \rangle \neq 0$ and then replaced by the so-called *Random Singlet Phase* [1]. Here, we adress the question of the two-dimensionnal case on the square lattice. When non-frustrating randomness in the AF exchanges is introduced, we show that the situation for the following Hamiltonian $\mathcal{H}_{2d} = \sum_{\langle i,j \rangle} J_{i,j} \vec{S}_i \cdot \vec{S}_j$, is completely different from the one dimensionnal case. In fact, the extreme robustness of the $T = 0$ AF order parameter as well as the appearance of localized excitations with increasing disorder has been studied with the help of several theoretical tools: Exact Diagonalizations, modified Spin-Waves calculations and Quantum Monte Carlo simulations performed at extremely low temperature over thousands of disordered samples and for systems up to 32×32. Our results also lead to more general consideration about Griffiths singularities in random quantum magnets.

[1] D. S. Fisher, Phys. Rev. B **50**, 3799 (1994).

Nicolas Laflorencie
University of British Columbia

Date submitted: 30 Nov 2004

Electronic form version 1.4