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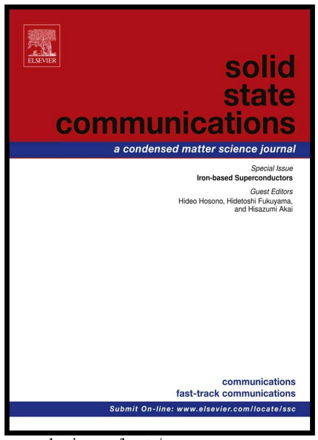

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Spin transport in the disordered phase of a frustrated antiferromagnet.

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Abstract

I analyze the spin transport, in the disordered phase, of the frustrated Heisenberg antiferromagnet with spin S =1 with next and next-nearest neighbor interactions on a square lattice. The spin conductivity is calculated using a SU(3) Schwinger boson formalism and the Kubo theory, within the ladder approximation. The spin conductivity exhibits a nonzero Drude weight at finite temperature.
Keywords: A. Antiferromagnet; D. Disordered phases; D. Spin transport.

1. Introduction

Low dimensional magnetic systems with competitive interactions exhibit exotic ground states with zero magnetization such as nematic phases, resonance valence bonds and quantum spin liquid states [1,2]. In this context the spin 1/2 square lattice antiferromagnet with next J_1 and next nearest neighbor J_2 interactions is one of the most studied models. However, the same model with spin S = 1, has been less studied. For some range of the parameter J_2/J_1 both models present a paramagnetic phase. The nature of the quantum ground state in this phase continues to be debated with several proposals being presented [3-5].

Although a lot of studies have been performed on the models discussed above, a calculation of spin transport quantities is missing. So, in this paper I will study the following Heisenberg antiferromagnet with spin S = 1 on a square lattice.

$$H = \frac{J_1}{2}\sum_{r,\delta}(S_r^x S_{r+\delta}^x + S_r^y S_{r+\delta}^y + S_r^z S_{r+\delta}^z)$$

$$+\frac{J_2}{2}\sum_{r,\delta}(S_r^x S_{r+2\delta}^x + S_r^y S_{r+2\delta}^y + S_r^z S_{r+2\delta}^z), \qquad (1)$$

where $\sum_{r,\delta}$ sums over the nearest neighbors, and $\sum_{r,2\delta}$ over the next-nearest neighbors. The inclusion of next-nearest neighbor along the diagonals is quite straightforward. This model was studied in [5], where it was shown that it presents a disordered phase, at T = 0, for $\alpha_{1c} < \alpha < \alpha_{2c}$, where $\alpha = J_2/J_1$, $\alpha_{1c} = 0.226$, and