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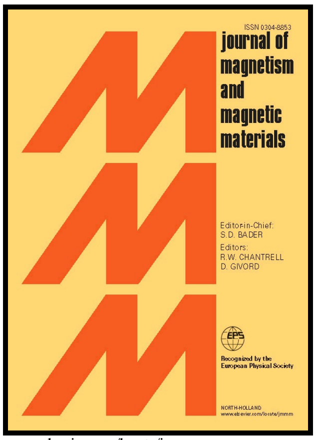

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Optical conductivity of the spin Lieb lattice

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Abstract

In the ferromagnetic insulator with the Dzyaloshinskii-Moriya interaction (DMI), we theoretically investigate and numerically verify an optical absroption. In other words, we investigate the optical absroption, $\sigma(\omega)$, of the spin Lieb lattice, a face-centered square lattice, subjected to a light spectrum with frequency ω. Using linear response theory and Green's function approach, the frequency dependence of optical conductivity (OC) has been obtained in the context of Heisenberg Hamiltonian. At low frequencies, the OC is found to be monotonically increasing with frequency for next-nearest neighbor (NNN) coupling, DMI strength (DMIS) and temperature. Also we have found that OC has a peak (absorption). Finally, we are investigated the effect of magnetic field on the OC of this system.

vspace*0.25cm **Keywords**: Spin Lieb lattice; Greens function; Optical conductivity

1 Introduction

The interest in the line centered square lattice, known as the 2D Lieb lattice, comes from the specific properties induced by its topology. The lattice is characterized by a unit cell containing three atoms, and a one-particle energy spectrum showing a three band structure with electron-hole symmetry, one of the branches being flat and macroscopically degenerate. For the infinite lattice, the three energy bands touch each other at the middle of the spectrum (taken as the zero energy), and the low energy spectrum exhibits a Dirac cone located at the point $\Gamma = (-\pi, \pi)$ in the Brillouin zone. Except for the presence of the flat band, the Lieb lattice shows similarities with the honeycomb lattice in what concerns both spectral and transport properties. Very recently, a concrete proposal of an optical Lieb lattice for cold atoms has been presented [1]. For instance, besides the presence of the Dirac cone, the energy spectrum in the presence of the magnetic field shows also a double Hofstadter picture,

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