9.7 cm

Phase transitions and crossovers in anisotropic two-dimensional quantum antiferromagnets

T. Roscilde[a], A. Cuccoli[b], V. Tognetti[b], P. Verrucchi[b], R. Vaia[c]

[a]Dipartimento di Fisica "A. Volta" dell'Università di Pavia and INFM, via A. Bassi 6, I-27100 Pavia, Italy

[b]Dipartimento di Fisica dell'Università di Firenze and INFM, via G. Sansone 2, I-50019 Sesto Fiorentino, Italy

[c] Istituto di Elettronica Quantistica del Consiglio Nazionale delle Ricerche, via Panciatichi 56/30, I-50127 Firenze, and INFM

We study the thermodynamic properties of anisotropic two-dimensional quantum antiferromagnets, of both easy-plane and easy-axis nature, as modeled by the XXZ model in zero field. We make use of the Quantum Monte Carlo method based on the continuous-time loop algorithm. The quantum simulations, performed in the limit of very small anisotropy and in the case $S = 1/2$, reveal that both the Ising and Berezinskii-Kosterlitz-Thouless universality class (for the easy-axis and easy-plane models, respectively) are well observed and the critical temperature remains finite even for anisotropies as small as 10^{-3}, which is the typical order magnitude for the anisotropies measured in the real layered compounds; this result rules out the possibility of quantum disorder to appear at finite temperature before the isotropic limit is reached. The phase diagram of the $S = 1/2$ 2d-XXZ antiferromagnet in the region of small anisotropies is then presented. Finally, in the easy-plane case direct comparison is made with experimental data of the $S = 1/2$ layered antiferromagnet $Sr_2CuO_2Cl_2$, and evidence is given for a Heisenberg-to-XY crossover in this compound, as conjectured by previous works.

13.4 cm

Subject category :

5. Phase Transitions and Critical Phenomena

Presentation mode :
oral

Corresponding author :
Tommaso Roscilde

Address for correspondence :
Tommaso Roscilde c/o Paola Verrucchi
Dipartimento di Fisica dell'Università di Firenze
via G. Sansone 1, I-50019 Firenze, Italy

Email address :
roscilde@fi.infn.it