Magnetic phase diagram of spatially anisotropic frustrated two-dimensional antiferromagnet

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The new magnetic materials such as the layered oxide high-temperature superconductor can be well described by the Heisenberg spin model with nearest-neighbor (NN) antiferromagnetic coupling J_1 and next-nearest-neighbor (NNN) antiferromagnetic coupling J_2. It is now well accepted that the model J_1--J_2 exhibits two phases displaying magnetic order at small J_2, separated by an intermediate paramagnetic phase in the interval $J_{c1}<J_2<J_{c2}$. The ground state for $J_2<J_{c1}$ exhibits Neél magnetic order, whereas for $J_2>J_{c1}$ it exhibits collinear stripe order. A generalization of the frustrated J_1-J_2 model is the J_1^x--J_1^y--J_2 model where J_1^y is the directional anisotropy parameter. The nearest-neighbor bonds have different strength J_1^x and J_1^y in the x and y directions, respectively. The effect of the coupling J_1^y on the Neél and stripe states is investigated. Our aim here is to further the study of this model by using the quantum many-body Green function method. It has been applied successfully to calculate with high accuracy the properties of many lattice quantum spin systems.

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