The J_1-J_2 model on the anisotropic triangular and the square lattice: similarities and differences

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The Heisenberg model on a triangular lattice is a prime example for a geometrically frustrated spin system. However most experimentally accessible compounds have spatially anisotropic exchange interactions. As a function of this anisotropy, ground states with different magnetic properties can be realized. On the other hand, the J_1-J_2 model on the square lattice is a well-known example for frustration induced by competing exchange. The classical phase diagrams of the two models are related in a broad range of the control parameter $\phi = \tan^{-1}(J_2/J_1)$. In both cases three different types of ground states are realized, each model having a ferromagnetic and an antiferromagnetic region in the phase diagram, and a third phase with columnar magnetic order for the square lattice and an in general incommensurate spiral structure for the triangular lattice. Quantum effects lift degeneracies in the non-FM phases and lead to additional nonmagnetic regions in the phase diagrams. The contribution of zero point fluctuations to ground state energy and wave vector, ordered moment, magnetization and susceptibility is discussed. In particular we point out that the ordered moment shows non-monotonic dependence both on the applied magnetic field H and on the control parameter ϕ in the vicinity of the disordered regions.