Quasi Long Range Order of Defects in Frustrated Antiferromagnetic Ising Models on Spatially Anisotropic Triangular Lattices

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We study a novel phase in an antiferromagnetic Ising model on an anisotropic triangular lattice using a Monte Carlo method. It is known that there is no phase transition down to zero temperature in the model with only nearest-neighbor interactions, in which the exchange coupling of one direction is equal to or stronger than those of other two directions. In the presence of the anisotropy, i.e., the coupling of one direction being stronger than the others, the low-temperature physics is governed by domain-wall excitations (defects) residing on bonds of the strong-coupling direction. In this presentation, we show that an additional small attractive interaction between defects (introduced by adding a ferromagnetic next-nearest-neighbor interaction in the weak-coupling direction) leads to a Berezinskii-Kosterlitz-Thouless (BKT) transition at a finite temperature. The BKT phase can be viewed as the phase with a quasi long-range order of defects. We numerically determine the phase diagram in a wide parameter regime, and also argue the phase structure from statistical-mechanics and field-theory viewpoints.