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Critical and Compensation Temperatures of the Ising Bilayer System Consisting of Spin-1/2 and Spin-1 Atoms

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The existence of the tricritical points which is indicated with (•)'s and the second-order phase transitions along $J_3 = 0$ between the (•)'s and triple points are incorrect in Fig. 5 and Fig. 6 [1]. Unfortunately, these points was wrongly interpreted by us previously.

In the absence of the interlayer coupling, i.e. $J_3 = 0$, the model has to converge to the behaviors of two uncoupled Ising lattices with spin-1/2 and spin-1. It is well-known that the order-disorder temperature increases with the increasing spin value. Thus the upper layer with spin-1/2 [2] has a lower order-disorder temperature than the lower layer with spin-1 [3]. So the (•)'s are the end points of the second-order phase transition lines for the magnetization of the upper layer along $J_3 = 0$, but they act as the first-order lines for the total and staggered magnetizations and thus their end points are the isolated critical points. Above these isolated critical points the system is driven by the lower layer with spin-1 along $J_3 = 0$, since the upper layer stays disordered at these temperatures. As a result, the system jumps to the critical temperature values of the spin-1 from the (•)'s. Therefore, the triple points are just the well-known ordering transition of the single layer Bethe lattice consisting of spin-1 atoms for given values of q (see Fig. 5) or J_2/J_1 (see Fig. 6). It should also be mentioned that there is a critical value J_2 such that the magnetization of the lower layer goes to zero before the upper layer and this is when the magnetizations of the layers can compensate each other.

It is concluded that in Figs. 5 and 6, the (•)'s are the isolated critical points in the form of the first-order phase transitions for the total and staggered magnetizations and the second-order line along $J_3 = 0$ is the line of no transitions between the isolated critical and the triple points.

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