

PHASE DIAGRAMS OF POTTS MODEL WITH COMPETING BINARY-TERNARY-QUATERNARY INTERACTIONS ON CAYLEY TREE OF ORDER THREE

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ABSTRACT

We investigate the phase diagram of the Potts model with competing binary interactions J_1 , ternary interactions J_t , and quaternary interactions J_q on the Cayley tree of order 3. At vanishing temperature T , the phase diagram is fully determined for all values and signs of J_t/J_1 , J_q/J_1 and T/J_1 . The phase diagram shows the appearance of additional phases: Antiferromagnetic, Period 5, Period 7, Period 9, Period 11 and Period 12 which are in addition to the expected Ferromagnetic, Paramagnetic, Antiphase and Period 6 phases for the case of nonzero J_q for several ranges of the competing parameters. As a result, there was a significant effect of additional new phases in the phase diagrams when the order of the Cayley tree is extended up to the order 3.

Keywords: Potts model, Binary Interaction, Ternary Interaction, Quaternary Interaction, Phase diagram

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