

## Phase Diagram for Ashkin-Teller Model on Bethe Lattice

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**Abstract:** Using the recursion method, we study the phase transitions of the Ashkin-Teller model on the Bethe lattice, restricting ourselves to the case of ferromagnetic interactions. The isotropic Ashkin-Teller model and the anisotropic one are respectively investigated, and exact expressions for the free energy and the magnetization are obtained. It can be found that each of the three varieties of phase diagrams, for the anisotropic Ashkin-Teller model, consists of four phases, i.e., the fully disordered paramagnetic phase Para, the fully ordered ferromagnetic phase Ferro, and two partially ordered ferromagnetic phases  $\langle\sigma\rangle$  and  $\langle\sigma\tau\rangle$ , while the phase diagram, for the isotropic Ashkin-Teller model, contains three phases, i.e., the fully disordered paramagnetic phase Para, the fully ordered ferromagnetic phase Baxter Phase, and the partially ordered ferromagnetic phase  $\langle\sigma\tau\rangle$ .

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