Critical Behaviour of the Ferromagnetic Spin-$\frac{3}{2}$ Blume-Emery-Griffiths Model with Repulsive Biquadratic Coupling

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The critical behaviour of the ferromagnetic spin-$\frac{3}{2}$ Blume-Emery-Griffiths model with repulsive biquadratic coupling in the absence and presence of an external magnetic field is studied by using the lowest approximation of the cluster variation method, which is identical with the mean-field approximation. Thermal variations of the order parameters are investigated for different values of the interaction parameters and the external magnetic field. The complete phase diagrams of the system are calculated in the $(kT/J, K/J)$, $(kT/J, D/J)$ and $(kT/J, H/J)$ planes. Five new phase diagram topologies are obtained, which are either absent from previous approaches or have gone unnoticed. A detailed discussion and comparison of the phase diagrams is made.

Key words: Spin-$\frac{3}{2}$ Blume-Emery-Griffiths Model; Cluster Variation Method; Thermal Variations of Order Parameters; Phase Diagrams.