Magnetic properties of a mixed spin-3/2 and spin-5/2 Heisenberg ferrimagnetic system using Green's function method

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The magnetic behaviors of a mixed spin-3/2 and spin-5/2 Heisenberg ferrimagnetic system on a square lattice are studied by using the double-time temperature-dependent Green's function technique. In order to decouple the higher order Green's functions, Anderson and Callen's decoupling and random phase approximations have been used. The system is described in presence of an external magnetic field. We illustrate the influences of the nearest, next-nearest-neighbor interactions and the single-ion anisotropies with an external magnetic field on compensation and critical temperatures. We found that the system that includes only the nearest-neighbor interaction and the single-ion anisotropies does not have a compensation temperature. When the next-nearest-neighbor interactions exceed a certain minimum value, compensation temperature begins to appear. The magnetization curves contain the first order phase transition for the negative values of anisotropy parameters. When the system is subject to an external magnetic field, one observes the compensation temperature in a certain range of the magnetic field. Moreover, there is a discontinuity in magnetization curve, that is, the first order phase transition. Compensation temperature increases with increasing the magnetic field while the temperature where magnetization is discontinuous decreases with increasing the magnetic field, until they become equal for a certain value of magnetic field and latter the compensation temperature disappears. Susceptibility of the system is zero at absolute zero but it makes a peak at the critical temperature.

1. Zubarev D.N., Usp.Fiz.Nauk., 1960, **71**, 71.
2. Bogolyubov N.N., Tyablikov S.V., Dokl. Akad. Nauk. SSSR, 1959, **126**, 533.
3. Anderson F.B., Callen H.B., Phys. Rev., 1964, **136**, A1068.
4. Buendìa G.M., Hurtado N., Phys. Stat. Sol. (b), 2000, **220**, 959.
5. Li J., Du A., Wei G., Physica B, 2005, **368**, 121.
6. Bobák A. et al, Physica A, 2011, **390**, 1953.