Sequences of ground states in frustrated rings disturbed by a single bond defect or additional central spin

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We have found the universal sequence of the ground states for antiferromagnetic frustrated rings with the odd number of the local spins s and a single bond defect α described by the isotropic Heisenberg Hamiltonian [1] and we extended the analysis to the centered rings [2]. The sequence revealed is characterized by the total spin $S \leq s$ and contains all the spin numbers belonging to the interval allowed. It validates the classification of spin frustration in this type of nanomagnets. The conclusions are similar for the centered rings. Interestingly, the Lieb-Mattis level ordering [1] $E(S'+1) > E(S')$ for $S' \geq S$ is valid despite the lack of bipartiteness, where $E(S')$ is the lowest energy of the states described by the quantum number S'. Our calculations, pointing out the role of bipartiteness [1,2], have revealed the unexpected features of the model in question: the rings with enlarged nonbipartite structure seem to inherit the Lieb-Mattis theorem consequences of their bipartite archetypes. Our findings may facilitate the modeling of these systems and prompt the routes of rationalized search for new nanomagnets with designed properties.

References:

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