

Collinear and noncollinear configurations in classical geometrically frustrated ringshaped systems

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Geometrically frustrated quantum spin systems (with competing antiferromagnetic couplings) show Kahn's degenerate frustration [1] for some specific values of Heisenberg Hamiltonian parameters [2,3]. We show that in the case of classical counterparts of systems considered in Ref. 3 (rings with a defect bond and centered rings) degenerated configurations with the lowest energy are present for Hamiltonian parameters lying in the well-determined intervals. In these domains such configurations are planar but noncollinear with continuous changes of the net magnetic moment with respect to the Hamiltonian parameters. Outside these domains there is unique collinear ground state configuration (neglecting choice of the net magnetic moment direction). These domains are separated by well determined critical values of the Hamiltonian parameters. Numerically exact calculations for quantum systems [3] strongly confirm that determined properties of their classical counterparts realize the classical limit $s \rightarrow \infty$.

References:

- [1] O. Kahn, Chem. Phys. Lett. **265**, 109 (1997); J. Schnack, Dalton Trans. **39**, 4677 (2010)
- [2] M.L. Baker *et al.*, Proc. Nat. Acad. Sci. USA **109**, 19113 (2012)
- [3] G. Kamieniarz, W. Florek, and M. Antkowiak, Phys. Rev. B **92**, 140411(R) (2015); W. Florek, M. Antkowiak, and G. Kamieniarz, Phys. Rev. B **94**, 224421 (2016)