Frustration in odd-numbered AFM rings with bond defect

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Synthesis of odd-numbered antiferromagnetic rings [1] has reopened discussion on frustration in quantum spin systems [2,3]. Definitions used in the case of the classical systems [4] cannot be applied to quantum ones. The degenerate frustration [5] describes systems with competing interactions and is restricted to models with spin degenerated ground states. Within this approach a system of three spins $s = 1$ with equal antiferromagnetic (AFM) couplings is *nonfrustrated*. We discuss an AFM system containing odd number of spins s, where one bond is 'defected', i.e. $J' = \alpha J$. Within the Ising model this system is frustrated for any $\alpha > 0$. Similarly, in the vector spin model, but one observes changes in spin configurations above $\alpha_c = 1/(n-1)$. According to the Kahn definition the quantum system is frustrated only for specific values of α. We propose and discuss a 'frustration measure', which tends to its classical version for $s \to \infty$, but preserves some features of quantum AFM systems. The relation between bipartiteness and frustration is also discussed.

References:

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