

Colloquium

Exotic Spin Systems and their Quantum Phases

S Ramasesha

IISc, Bengaluru

Study of spin chains and spin ladders has been of enduring interest both from a theoretical standpoint and from materials perspective. Many low-dimensional spin systems belonging to this class of materials have been realised experimentally. After a brief introduction to quantum phase transitions and dimerised and frustrated spin chains, a new class of spin ladders which we call two legged skewed spin ladders are introduced. These systems resemble periodic fused spin rings with at least one of the rings having spin frustration. The 5/7 system, with alternately fused five and seven membered rings, exhibits ground state spin dependent on the size of the system as well as on (J_1/J_2) the ratio of the rung to leg exchange interactions. At intermediate values of this ratio, the system shows a re-entrant singlet phase. For some values of the model parameter the system shows broken vector chiral symmetry as well as bond order wave (BOW) ground state. The 3/5 ladder shows a quantum phase transition from a ferromagnetic state to a singlet ground state above a critical (J_1/J_2) . The 3/4 ladder shows a ferromagnetic phase for all values of (J_1/J_2) above a critical value. The 5/5 skewed ladder has a singlet ground state for all values of (J_1/J_2) and exhibits a BOW phase over a small interval of (J_1/J_2) . We have extensively studied spin densities, spin correlations, bond orders and magnetisation plateaus to understand the nature of the ground state as a function of the model parameter.

Monday, Jan 8th 2024

16:00 Hrs (Tea / Coffee 15:45 Hrs)

Auditorium, TIFR-H