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Statistical quantum mechanics and entanglement in anisotropic Heisenberg model. YOU-LING CHIANG, Department of Physics, Chinese Culture University, ARMEN KOCHARIAN, Department of Physics and Astronomy, California State University, CHEE YANG, Department of Physics, Tamkang University — The single site quantum and thermal entanglement, concurrences, quantum phase transitions and corresponding quantum critical points are studied in small spin $s = \frac{1}{2}$ and 1 in ferromagnetic and antiferromagnetic Heisenberg dimers. The grand canonical ensemble of Heisenberg clusters is also used for exact calculations of thermal properties, quantum and thermal entanglements of the various spin and fermionic lattice models in the presence of magnetic field. We study the magnetic phase transitions and crossovers driven by external field and temperature. The comparison with the exact solution for Heisenberg model in thermodynamic limit for the limiting cases is also provided. The small Ising, Heisenberg and Hubbard clusters are also used for comparison with the exact Bethe ansatz solutions and predictions of traditional mean field theory and developed perturbation theory about generalized self- consistent solution.

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