The Quantum Spherical Model

Spherical Model Berlin, Kac, Lewis, Wannier (1952)

$$\mathcal{H} = \mu \sum_n S_n^2 - J \sum_{<n,m>} S_n S_m - H \sum_n S_n$$

$$\left\langle \sum_n S_n^2 \right\rangle = N^d = \text{amount of particles}$$

3^{rd} law of thermodynamics: quantum terms tinyObermair (1972)

$$\hat{\mathcal{H}} = \frac{g}{2} \sum_n \hat{P}^2 + \mu \sum_n \hat{S}_n^2 - J \sum_{<n,m>} \hat{S}_n \hat{S}_m$$

$$\left[\hat{S}_n, \hat{P}_m\right] = i\hbar\delta_{nm}$$

Anisotropic Extension of the Quantum Spherical Model

Interacting Momenta

$$\hat{\mathcal{H}} = \frac{g}{2}\sum_n \hat{P}^2 + \mu \sum_n \hat{S}_n^2 - J\frac{1+\lambda}{2}\sum_{<n,m>} \hat{S}_n\hat{S}_m - \frac{gJ}{\mu}\frac{1-\lambda}{2}\sum_{<n,m>} \hat{P}_n\hat{P}_m$$

universal critical behaviour (exponents, amplitudes)

reentrant phase transition