

Hierarchical spherical model as a viscosity limit of $O(N)$ Heisenberg Model

A continuum version of the Dyson hierarchical approximation to the $O(N)$ classical Heisenberg model is considered in order to understand dynamical properties of the Lee--Yang zeros of spin systems under renormalization group (RG) transformation.

We combine two tools in our analysis. The first is related to the "proximity" to Berlin--Kac spherical model as N goes to infinity. The second is a recursion relation to "a priori" block--spin distribution derived for hierarchical models.

The renormalization group in the continuum reduces to a semilinear parabolic differential equation (PDE), which does not preserve the usual Lee--Yang property. However, the viscosity N -to-infinity limit equation can be explicitly solved by the method of characteristics and the renormalization group trajectories of the $O(N)$ Heisenberg model be controlled by a Gevrey asymptotic series of order 2. In this talk central limit theorems of N -to-infinity PDE model will be presented based on a geometric function interpretation. We shall also discuss the summability property of the formal asymptotic series.