## [P7] Joint density of state of complex spin systems

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To describe a spin system in the state of a thermodynamic equilibrium one is necessary to know the partition function which contains whole information about the statistical properties. The problem is that quantity of members of partition function increases exponentially with the increasing number of particles. Therefore, in statistical physics the Monte Carlo methods are used widely. The Wang Landau (WL) algorithm is modern efficient method for calculation of the energy density of states (DOS) $g(E)$ with high accuracy. It was successfully applied to many problems [1, 2].

WL-method is based on the Monte Carlo generation of states and sampling of the number of states with a given energy $E$ [1]:

$$Z = \sum_{E} g(E) exp[\frac{-E}{kT}]$$

This method can be modified by adding an additional parameter e.g. magnetization per spin $M$ and in this case DOS will have the form $g(M, E)$. Joint density of state (jDOS) provides more information than the conventional DOS which depends only on energy [3]. We used the Ising model as a test of results of our software in comparison with known results. In this work, the properties and thermodynamics of systems with complex and rough energy landscape for which the calculation of the partition function is difficult, such as spin ice and spin glass using a modified method of Wang-Landau were studied.

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