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A Mermin--Wagner theorem for quantum Gibbs states on 2D graphs, I

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This is the the first of a series of papers considering properties of quantum systems over 2D graphs or manifolds, with continuous spins. In the model considered here the phase space of a single spin is a compact Riemannian manifold M, and spins are attached to sites of a graph (Γ ,Υ) satisfying a special bi-dimensionality property. The kinetic energy part of the Hamiltonian is minus a half of the Laplace--Beltrami operator $-\Delta /2$ on M. Assuming that the interaction potential is C^2-smooth and invariant under the action of a connected compact Lie group ${\ttG}$ on M preserving the Riemannian metric, we use ideas and techniques originated from papers [DS], [P], [FP] and [ISV], in combination with the Feynman--Kac representation, to prove that a Gibbs state corresponding to such a Hamiltonian and lying in a certain class $\fG$ (defined in the text) is ${\ttG}$-invariant. An example is given where the interaction potential is singular and there exists a Gibbs state which is not ${\ttG}$-invariant.
In forthcoming papers we will discuss other relevant issues about 2D quantum systems.

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