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Quantum spin glass state of the Heisenberg model in two dimensions

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By means of a Neural Network Variational Wave Function numerical method, we study the Quantum Spin Glass phase of a disordered Heisenberg model in two spatial dimensions. As the fraction of antiferromagnetic bonds is increased, we find that the model has a QSG phase clearly distinct from the ferro- and antiferro-magnetic order. We further investigate this phase using a semiclassical approximation, and characterize the Bogoljubov spin waves as localized excitations on top of the classical ground state. We posit that the reason for the stability of the QSG phase as opposed to the instability of the SG phase in the corresponding classical model is to be addressed to the localization of such excitations.

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