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Quantum Percolation in Two-dimensional antiferromagnets
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The interplay of geometric randomness and strong quantum fluctuations is one of the most exciting topics in quantum many-body physics. Recently the problem whether a system of two-dimensional Heisenberg antiferromagnets on a square lattice can be driven through a quantum phase transition by either bond or site dilution attracts lots of research interests. Both experimental result and numerical analysis give evidence that the system with homogeneous site and bond dilution is driven through a classical geometric percolation transition. In this work, we show that non-homogeneous bond dilution introduces a different scenario – the percolative quantum phase transition. The quantum percolation is investigated by Quantum Monte Carlo simulations. A new phase characterized by an infinite percolating network with vanishing antiferromagnetic order parameter appears as an intermediate phase between the geometric disordered phase and the antiferromagnetic ordered phase.

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