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Quantum Phase Transition of Heisenberg Antiferromagnet with Four-Spin Ring Exchange DAOXIN YAO, VALERI N. KOTOV, ANTONIO H. CASTRO NETO, DAVID K. CAMPBELL, Department of Physics, Boston University — We discuss the S=1/2 Heisenberg antiferromagnet model on a square lattice with nearest-neighbor (J) and plaquette (K) exchanges, which exhibits a quantum phase transition from a spontaneously dimerized phase to Néel order at a critical coupling (K/J). We calculate the triplon spectrum starting from the Valence Bond Solid phase and show that good agreement with recent Monte Carlo data (A. W. Sandvik) can be achieved. The quantum phase transition is signaled by vanishing of the triplon gap at the Néel vector. We find that strong quantum fluctuations of the dimer background are present, especially near the critical point, which signals a tendency towards restoration of lattice symmetry as evidenced by the strong reduction of the dimerization. Even though within our method full restoration of symmetry is impossible to achieve, the above features are consistent with a critical point exhibiting "Deconfined quantum criticality," of which the present model is believed to be the first example.

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