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Field-induced magnetization jumps and quantum criticality in the 2D J-Q model[1] ADAM IAIZZI, ANDERS SANDVIK, Boston Univ — The J-Q model is a 'designer hamiltonian' formed by adding a four spin 'Q' term to the standard antiferromagnetic $S = 1/2$ Heisenberg model. The Q term drives a quantum phase transition to a valence-bond solid (VBS) state: a non-magnetic state with a pattern of local singlets which breaks lattice symmetries. The elementary excitations of the VBS are triplons, i.e. gapped S=1 quasiparticles. There is considerable interest in the quantum phase transition between the Néel and VBS states as an example of deconfined quantum criticality. Near the phase boundary, triplons deconfine into pairs of bosonic spin-1/2 excitations known as spinons. Using exact diagonalization and the stochastic series expansion quantum monte carlo method, we study the 2D J-Q model in the presence of an external magnetic field. We use the field to force a nonzero density of magnetic excitations at T=0 and look for signatures of Bose-Einstein condensation of spinons. At higher magnetic fields, there is a jump in the induced magnetization caused by the onset of an effective attractive interaction between magnons on a ferromagnetic background. We characterize the first order quantum phase transition and determine the minimum value of the coupling ratio $q \equiv Q/J$ required to produce this jump.

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Adam Iaizzi
Boston Univ

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