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Unconventional versus conventional destruction of square lattice SU(N) magnetism[1]

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Recently we have found SU(N) symmetric square lattice spin models of quantum anti-ferromagnets, which have quantum phase transitions between magnetic and non-magnetic phases for arbitrary N, and which are nonetheless free of the "sign-problem" of quantum Monte Carlo. The absence of the notorious sign-problem allows detailed unbiased numerical simulations of two-dimensional magnetic quantum phase transitions on lattices containing in excess of 10^4 spins. Depending on the absence or presence of uncompensated Berry phases in our microscopic models we find evidence for both conventional first order phase transitions and unconventional continuous quantum phase transitions at which both Néel- and valence bond solid-order (VBS) are *simultaneously* quantum critical. A detailed quantitative study of the Néel and VBS scaling dimensions as a function of N provides compelling evidence that the long-wavelength description of these quantum critical points may be found in the CP^{N-1} gauge theory, as predicted by the deconfined quantum criticality scenario. R. K. Kaul and A. W. Sandvik, http://arxiv.org/abs/1110.4130. R. K. Kaul (forthcoming).

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