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Universal Scaling of the Néel Temperature of Near-Quantum-Critical Quasi-Two-Dimensional Heisenberg Antiferromagnets DAOXIN YAO, ANDERS W. SANDVIK, Department of Physics, Boston University — In many strongly correlated materials, layered structures with weak interlayer couplings can lead to phase transitions, dimensional cross-overs, and related phenomena. We use a quantum Monte Carlo method to calculate the Néel temperature (T_N) of weakly coupled S=1/2 Heisenberg antiferromagnetic layers consisting of coupled ladders. This system can be tuned to three different two-dimensional scaling regimes for $T > T_N$: renormalized classical, quantum critical and quantum disordered regimes. From our calculations, the Néel temperature shows completely different behavior (which is determined by the single-layer phase) when interlayer layer coupling J' is extremely weak. The single-layer mean-field theory of the two-dimensional staggered susceptibility and interlayer coupling J' applies not only in the renormalized classical regime, but also in the quantum critical regime and part of the quantum disordered regime with a coordination number renormalization $k_2 \sim 0.65 - 0.70$. The product of J' and $\chi(\pi, \pi, 0)$ is found to be a constant (0.23) in all the regimes. These constants could be very useful to extract the interlayer couplings experimentally. $J'S(\pi, \pi, 0)/T_N$ distinguishes in the three regimes when J' is small. This study can be related to the high Tc cuprates with striped phase. (D. X. Yao and A. W. Sandvik, cond-mat/0606341)

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