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Haldane gap evolution in quasi-one-dimensional spin-1 Heisenberg antiferromagnets KEOLA WIERSCHEM, PINAKI SENGUPTA, Nanyang Technological University — We study a spatially anisotropic spin-1 antiferromagnetic Heisenberg model on simple cubic lattices that is equivalent to a system of coupled chains with interchain coupling J and intrachain coupling set to unity. In the limit of uncoupled chains ($J = 0$), the ground state is known to be gapped as per the Haldane conjecture. As the coupling is turned on, this gapped phase persists up to a critical value J_c beyond which there is a quantum phase transition to the gapless Néel state with long range magnetic order. Using the stochastic series expansion quantum Monte Carlo method, we accurately determine J_c and calculate the string order parameter in the gapped phase for $0 < J < J_c$ to conclusively demonstrate the presence of hidden order in the quasi-one-dimensional system. We also study the evolution of the low energy dispersion across the Haldane to Néel quantum phase transition, as gapped modes give way to gapless modes. Finally, incorporating a uniaxial single-ion anisotropy D into our model system, we map out the ground state phase diagram in the J–D plane and compare it to past theoretical calculations.

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