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1D SU(N) spin physics with ultracold alkaline earth atoms S.R. MANMANA, K.R.A. HAZZARD, JILA (CU and NIST), and Dep. of Physics, U Colorado, Boulder, CO 80309, G. CHEN, Dep. of Physics, U Colorado, Boulder, CO 80309, A.E. FEIGUIN, Dep. of Physics and Astronomy, U Wyoming, Laramie, WY 82071, V. GURARIE, M. HERMELE, Dep. of Physics, U Colorado, Boulder, CO 80309, A.M. REY, JILA (CU and NIST), and Dep. of Physics, U Colorado, Boulder, CO 80309 — We treat SU(N) Hubbard chains using the density matrix renormalization group (DMRG) and an approximate Bethe ansatz. We characterize the accuracy of the Bethe ansatz for $N > 2$ and find it agrees with the DMRG results for the ground state energy, with relative errors $\varepsilon < 5\%$ for $N \leq 4$. Based on this, we determine the regimes of validity of perturbation theory for all values of N. In particular in the strong coupling regime at unit filling, we identify the parameter range in which the ground state is described in terms of SU(N) Heisenberg models and find that it depends only weakly on N, supported by comparing correlation functions computed for the SU(N) Hubbard and Heisenberg models. This provides a prediction for the parameter range in which quantum simulators with ultracold alkaline earth atoms can uncover unconventional SU(N) spin physics. We complement the study by discussing the fidelity susceptibility, which appears to possess a minimum at the critical point U_c, and the Luttinger parameter in the gapless phases.

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