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Theoretical study of a one-dimensional chain of alternating spin-1 and electron sites with spin-mediated hopping WING-HO KO, HONG-CHEN JIANG, Kavli Institute for Theoretical Physics, University of California, Santa Barbara, Santa Barbara, California 93106, USA, JEFFREY RAU, Department of Physics, University of Toronto, Toronto, Ontario M5S 1A7, Canada, LEON BALENTS, Kavli Institute for Theoretical Physics, University of California, Santa Barbara, Santa Barbara, California 93106, USA — Motivated by the nickel valance controversy in the perovskite nickelate $RNiO_3$, we consider a one-dimensional chain consisting of alternating spin-1 ("nickel") and electron ("oxygen") sites, which in addition to the usual electron hopping and spin-spin interaction between the spin-1 and the electron also contains a spin-1 mediated electron hopping term. Using density-matrix renormalization group (DMRG), we obtain the phase diagram of such model, as well as various correlation functions in each phase. Importantly, for certain range of parameters the model exhibits a quasi-long-range spiral (QS) order. To understand the DMRG results, we construct a mean-field theory based on Schwinger fermion decomposition of the spin-1 spins, from which we argue that the QS phase corresponds to a phase in proximity to the spin Bose metal state proposed by Sheng, Motrunich, and Fisher [Phys. Rev. B, 79, 205112 (2009)].

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