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Extended Valence-Bond Solid Picture for Quasi-One-Dimensional Quantum Magnets MUNEHISA MATSUMOTO — Ground-state gapped phases of quasi-one-dimensional quantum magnets are given an comprehensive interpretation based on an extended valence-bond solid (VBS) picture. We introduce composite spins with the enlarged spin magnitude in the ground state and regard the system as an effective single spin chain that consists of composite spins. The relevance of the composite spins in the ground state is revealed by the effects of dimerization in the spin-spin couplings. In order to characterize the gapped phases, we inspect the configuration of valence bonds by calculating the appropriate order parameters by the quantum Monte Carlo method with the continuous-time loop algorithm. The so-called short-range resonating-valence bond solid state is identified to be an extended VBS state. Dimensional crossover to the two-dimensional systems is also discussed.

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