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Tunable Superfluidity with Ultracold Polar Molecules on quasi-1D Optical Lattices SALVATORE R. MANMANA, JILA & CU Boulder, 440 UCB, Boulder, CO 80309, ALEXEY V. GORSHKOV, KEVIN A. KUNS, IQI, CalTech, Pasadena, CA 91125, GANG CHEN, JUN YE, JILA & CU Boulder, 440 UCB, Boulder, CO 80309, EUGENE DEMLER, MIKHAIL D. LUKIN, Physics Department, Harvard University, Cambridge MA 02138, ANA MARIA REY, JILA & CU Boulder, 440 UCB, Boulder, CO 80309 — By selecting two dressed rotational states of ultracold polar molecules on an optical lattice, strong electric dipole-dipole interactions allow to directly emulate spin Hamiltonians and a highly tunable generalization of the $t-J$ model, the $t-J-V-W$ model. We present the phase diagram of the simplest experimentally realizable case, the $t-J_\perp$ model with long-range dipolar spin-exchange interactions, on (quasi) one-dimensional chain and ladder systems as obtained from extensive density matrix renormalization group (DMRG) calculations. For the chain, we discuss the possible realization of unconventional quasi-long-range-order caused by the dipolar interactions. While the phase diagram of the dipolar $t-J_\perp$ chain is similar at low filling to that of the standard t-J chain, the superconducting region is strongly enhanced. We approach the ladder systems by coupling square plaquettes and comparing the numerical results to a mean-field description. We discuss the possibility to enhance superconductivity in these ladder systems by the presence of the dipolar interactions.

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