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Tunable Holstein model with cold polar molecules FELIPE HERRERA, ROMAN V. KREMS, University of British Columbia — We show that ultracold polar molecules trapped on an optical lattice can be used for quantum simulation of the Holstein polaron model. Rotational excitation of molecules on the lattice produces excitons that are coupled to lattice phonons due to long-range dipole - dipole interactions. We show that the properties of the excitons and the phonons as well as the exciton-phonon couplings can be controlled by applying a dc electric field and by varying the intensity of the trapping laser field. We discuss the application of polar molecules on an optical lattice for quantum simulation of non-Markovian open quantum systems. We also explore the possibilty of realizing a transition from the strongly coupled Holstein polaron limit to the polaron regime described by the Su-Schrieffer-Heeger model. Reference: F. Herrera and R. V. Krems, Phys. Rev. A 84, 051401(R) (2011)

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