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Resonant scattering of rotational excitons in optical lattices with polar molecules MARINA LITINSKAYA, FELIPE HERRERA, ROMAN KREMS, Department of Chemistry, University of British Columbia, Vancouver BC, V6T1Z1, Canada — We consider ultracold polar molecules in the ro-vibrational ground state trapped on an optical lattice with one molecule per lattice site. Rotational excitation of molecules produces rotational excitons that can propagate throughout the optical lattice due to long-range dipole-dipole interaction between molecules. Unlike excitons in most naturally occurring solids, these rotational excitons have a negative effective mass. Molecular impurities introduced into the lattice break the translational symmetry and scatter excitons. We show that the exciton-impurity interaction strength can be tuned by an external electric field, leading to exciton-impurity scattering resonances. This can be used to realize different kinetic regimes of exciton dynamics, from free propagation to Anderson localization. The negative effective mass of the excitons results in resonant scattering produced by repulsive, and not attractive, scattering potentials.

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