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Effect of optical lattice and microwave fields on the formation and confinement of ultracold molecules[1] SVETLANA KOTOCHIGOVA, Temple University, Physics Department, EITE TIESINGA, National Institute of Standards and Technology — Our goal is to estimate the effect of optical lattice fields on photoassociative formation of ultracold molecules from their atoms. We examine production of translationally cold molecules by considering a stimulated Raman process to specific intermediate ro-vibrational levels of excited states. We propose that for photoassociation in a lattice the effect of excited state spontaneous decay can be strongly diminished. We also investigate the interaction of polar molecules with optical lattices and microwave fields. We theoretically demonstrate the existence of frequency windows in the optical domain where the complex internal structure of the molecule does not influence the trapping potential of the lattice. In such frequency windows the Franck-Condon factors are so small that near-resonant interaction of vibrational levels of the molecule with the lattice fields have a negligible contribution to the polarizability and light-induced decoherences are kept to a minimum. In addition, we show that microwave fields can induce a tunable dipole-dipole interaction between ground-state rotationally symmetric molecules. A combination of a carefully chosen lattice frequency and microwave-controlled interaction between molecules will enable trapping of polar molecules in a lattice and possibly realize molecular quantum logic gates.

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