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Enhancement of Ultracold Molecule Formation Using Shaped Nanosecond Frequency Chirps JENNIFER CARINI, Department of Physics, University of Connecticut, Storrs, CT 06269, SHIMSHON KALLUSH, Department of Physics, ORT-Braude College, P.O. Box 78, 21982 Karmiel, Israel; Department of Physical Chemistry and the Fritz Haber Research Center fo, RONNIE KOSLOFF, Department of Physical Chemistry and the Fritz Haber Research Center for Molecular Dynamics, Hebrew University of Jerusalem, Jerusalem 91904, Israel, PHILLIP GOULD, Department of Physics, University of Connecticut, Storrs, CT 06269 —
We demonstrate that judicious shaping of a nanosecond-time-scale frequency chirp can dramatically enhance the formation rate of ultracold molecules. Starting with ultracold ^{87}Rb atoms, we apply pulses of frequency-chirped light to first photoassociate the atoms into excited molecules and then, later in the chirp, de-excite these molecules into a high vibrational level of the lowest triplet state. The enhancing chirp shape passes through the absorption and stimulated emission transitions relatively slowly, thus increasing their adiabaticity, but jumps quickly between them to minimize the effects of spontaneous emission. Comparisons with quantum simulations for various chirp shapes support this enhancement mechanism. Schemes for further improvements of the formation rate will also be presented. This work is supported by DOE and BSF.

Jennifer Carini
Department of Physics, University of Connecticut, Storrs, CT 06269

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