Implementation of a single femtosecond optical frequency comb for rovibrational cooling

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Abstract

We show that a single femtosecond optical frequency comb may be used to induce two-photon transitions between molecular vibrational levels to form ultracold molecules, e.g., KRb. The phase across an individual pulse in the pulse train is sinusoidally modulated with a carefully chosen modulation amplitude and frequency. Piecewise adiabatic population transfer is fulfilled to the final state by each pulse in the applied pulse train providing a controlled population accumulation in the final state. Detuning the pulse train carrier and modulation frequency from one-photon resonances changes the time scale of molecular dynamics but leads to the same complete population transfer to the ultracold state. A standard optical frequency comb with no modulation is shown to induce similar dynamics leading to rovibrational cooling.