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Four-Photon Stark Induced Ladder Climbing Prepares Large Ensemble of H_2 in Selected High Lying Vibrational Levels[1] NANDINI MUKHERJEE, WILLIAM PERREAULT, RICHARD ZARE, Stanford Univ — To selectively prepare highly vibrationally excited quantum states of molecules like H_2, we present a novel multi-photon ladder-climbing technique where the successive rungs of the ladder are connected by Stark-induced adiabatic Raman passage (SARP). Previously, we have demonstrated that SARP achieves complete population transfer from the v =0 to the v =1 and v =4 levels of H_2. We show here that SARP can be generalized into a continuously coupled, multiphoton adiabatic passage which uses one or more intermediate states having strong Raman coupling to access highly vibrationally excited states weakly coupled to the ground state. As an example, we consider the case of four-photon coherent excitation to high vibrational levels of H_2 via an intermediate level coupled to both the initial and target levels by two-photon SARP. Using a sequence of commercially available single mode, nanosecond lasers, a pump pulse partially overlapping with two Stokes pulses, we show that the complete population of v =0 can be selectively transferred to the most weakly coupled v =6 and v =9 vibrational levels of H_2, without leaving any population stranded in the intermediate level. The present method provides a practical way of generating an entangled pair of fragments without resorting to an ultracold system.

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Nandini Mukherjee
Stanford Univ

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