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Multiphoton population transfer between rovibrational states of HF[1] TURKER TOPCU, FRANCIS ROBICHEAUX, Auburn University — Efficient population transfer by adiabatically chirping through a multiphoton resonance in microwave driven and impulsively kicked Rydberg atoms has been reported both experimentally and theoretically. Previous work has demonstrated that the physical mechanism responsible for the transition can be viewed as a classical process in phase space as well as a quantum mechanical resonant transition. Here we report on our classical and quantum mechanical simulations in which we have exploited this mechanism to vibrationally excite an HF molecule up to $|\nu = 4, J\rangle$ from its ground state using an intense IR pulse. We compare one-dimensional quantum and classical models where there are no rotational degrees of freedom. We find that for low laser intensities, the transition is classically forbidden although it occurs quantum mechanically through tunneling. We show that for larger peak intensities, the transfer can be looked upon as a classical transition in phase space, similar to that observed in the atomic case. We extend our simulations to fully three-dimensional quantum calculations and investigate the effect of coupling between different rotational pathways. We briefly discuss the effect of thermal averaging over the final J-states.

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Turker Topcu
Auburn University

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