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Raman transitions by chirped optical frequency combs: Prevention of decoherence

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We discuss femtosecond Raman type techniques to control molecular vibrations by implementing optical frequency combs with and without modulation. These techniques make use of multiple two-photon resonances induced by optical frequencies present in the comb. They provide a tool to study the details of molecular dynamics. We take into account decoherence in the form of spontaneous emission and collisional dephasing in order to ascertain an accurate model of the dynamics in the three-level system. We analyze the effects of odd and even chirps of the optical frequency comb in the form of sine and cosine functions on the population transfer. We compare the effects of these chirps to the results attained with the standard optical frequency comb to see if they increase the population transfer to the final deeply bound state in the presence of decoherence. We also analyze the inherent phase relation that takes place owing to collisional dephasing between molecules in each of the states. This ability to control the rovibrational states of a molecule with an optical frequency comb enables us to create deeply bound ultracold polar molecules from the Feshbach state.

Biography

Svetlana A. Malinovskaya has completed her Ph.D. in Theoretical Physics from Novosibirsk State University and Institute of Chemical Kinetics and Combustion of Russian Academy of Science. She was Postdoctoral Fellow in Ultrafast Optical Science at FOCUS Center at the University of Michigan and Alexander von Humboldt Fellow at the University of Heidelberg in Germany. Presently, she is an Associate Professor and the director of Ultrafast Dynamics and Control Theory Laboratory at Stevens Institute of Technology. She has published more than 50 papers in reputed journals and made more than 60 presentations at research conferences.

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