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Computational assessment of stimulated Raman adiabatic passage in embedded germanium nanocrystals[1] CEYHUN BULUTAY, DENIZ GUNCELER, Bilkent University — All-optical coherent population transfer is one of the key instruments of coherent control phenomena which is much needed for quantum information processing. One powerful scheme is the stimulated Raman adiabatic passage (STIRAP). It provides 100% population transfer in a Λ configuration achieved by two counter-intuitively ordered partially overlapping optical pulses which is robust against parameter variations. The major challenge is to achieve STIRAP in the solid-state. In this respect, Ge nanocrystals (NC) embedded in silica possess atomic-like states which is very convenient for coherent control schemes which is at the same time highly scalable and compatible with the mainstream solid-state technology. In this computational work, we provide a realistic assessment of STIRAP in a 4 nm Ge NC. The electronic structure and optical dipole matrix elements are computed using an atomistic pseudopotential Hamiltonian. A multi-level STIRAP scheme is implemented to incorporate the effects of large number of intermediate states which fall into the quasi-continuum part of the Ge NC states. Our extensive study over the parameter space provides working recipes for achieving STIRAP with the commonly available laser sources.

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Ceyhun Bulutay
Bilkent University

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