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Studies of electronic relaxation and coherent control in sensitized semiconductor surfaces.[1] VICTOR BATISTA, Yale University, LUIS REGO, Universidade Federal de Santa Catarina (UFSC) — This talk addresses the feasibility of using sequences of unitary pulses for coherent-control of quantum dynamical phenomena, including superexchange hole tunneling in sensitized TiO_2 surfaces and control of tunneling and decoherence in archetype model systems. The proposed dynamical decoupling scenario is based on the repetitive application of unitary pulses, affecting the interference phenomena between wave-packet components. The pulses affect the overall relaxation dynamics without collapsing the coherent-quantum evolution of the system. It is shown that both bound-to-bound state tunneling and bound-to-continuum tunneling processes can be inhibited and eventually halted by sufficiently frequent pulse fields that exchange energy with the system but do not collapse the unitary evolution or affect the potential energy tunneling-barriers. The reported results are therefore particularly relevant to the understanding of coherent optical manipulation of electronic excitations in semiconductor devices where performance is limited by quantum tunneling and decoherence.

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