MAR08-2007-001488

Abstract for an Invited Paper
for the MAR08 Meeting of
the American Physical Society

Non-resonant, non-perturbative Dynamic Stark Control of Quantum Dynamics.

ALBERT STOLOW, National Research Council

One of the most important non-resonant interactions is the dynamic Stark effect. In the non-perturbative but non-ionizing limit, an effective Hamiltonian can be constructed based upon a hierarchy of approximations (the Born-Oppenheimer Approximation, Slowly Varying Envelope Approximation, the Rotating Wave Approximation). In this situation, the effective Hamiltonian contains first order (dipole) and second order (polarizability) matter-field interactions which can lead to significant yet reversible changes to the molecular Hamiltonian. The first order term leads to a fast evolution which follows each optical cycle. The second order term causes an evolution which follows, by contrast, the envelope of the laser pulse. We discuss the use of the non-resonant second order Dynamic Stark Effect as a tool for controlling quantum systems without any net absorption of light. We illustrate this by examples chosen from problems in: (i) Control of branching ratios during non-adiabatic photodissociation; (ii) Control of 3D field free molecular frame alignment of asymmetric tops.