Abstract for an Invited Paper
for the DAMOP07 Meeting of
The American Physical Society

Photonic Reagents: Strong Field Laser Pulses for Controlling Chemical and Physical Processes

ROBERT LEVIS, Temple University

This presentation will focus on the latest developments in the area of using strong-field laser pulses to manipulate chemical systems in both the gas and condensed phase. The laser intensities are sufficient to alter the electronic Hamiltonian of a molecule or condensed phase system. In fact, the perturbations are on the order of the electronic level spacing between the ground and electronic states of any molecular system. This implies that anticipated chemical reactivity will be at least on the order of that induced by conventional reagents and enzymes. Strong laser fields are capable of inducing massive electron polarization and we now demonstrate that proton migration is also possible on the timescale of the laser pulse. In combination with laser pulse shaping methods and computer-based feedback control, strong field chemistry has initiated a plethora of new laser-chemistry experiments. Recent experiments involving the use of strong field chemistry to provide a novel, rapid, and selective sensing scheme will be discussed, as will dimensionality reduction tools to predict and navigate the high dimensional search spaces. The use of adaptive feedback to control laser-induced filamentation in the solution phase will also be described.