UNDERSTANDING OPTICAL STRONG FIELD PHYSICS FROM A QUANTUM THEORY PERSPECTIVE

Anthony F. Starace

Department of Physics and Astronomy
The University of Nebraska

The key features of intense laser ("strong field") interactions with atoms and molecules (such as the well-known plateaus in above threshold ionization (ATI) or detachment (ATD) spectra and in high-order harmonic generation (HHG) spectra) are currently understood largely in terms of the semi-classical "rescattering scenario" or "three step model" of P. Corkum [1] and of K. Schafer and collaborators [2]. In this talk we examine the quantum origins of these characteristic strong field processes [3] with a focus on aspects that cannot be understood on the basis of the semi-classical rescattering scenario, such as why ATI and ATD spectra are much more sensitive to the atomic target than HHG spectra, the influence of initial state symmetry on such spectra [4], the origin of resonant-like enhancements of strong field plateaus [5, 6, 7], non-tunnelling high harmonic generation [8], the laser ellipticity dependence of plateau cutoff energies [9], etc. Possibilities for probing these theoretical predictions for optical strong field processes with coherent x-rays are discussed.

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