Insights from high harmonic generation. Toy models

Sai Ramakrishna and Tamar Seideman

Northwestern University, Departments of Chemistry and Physics, 2145 Sheridan Rd, Evanston IL 60208, USA

High harmonic generation (HHG) is well understood in terms of a 3-step process, wherein tunnel ionization takes place close to the maximum of the electric field of an intense light pulse, generating a free-electron wave packet in the continuum that follows the electric field oscillations. If the field is linearly (or close to linearly) polarized, the electron will revisit the core, with the most energetic recollisions taking place near the second zero of the laser electric field after the electron release. One of the possible consequences of such coherent, energetic recollision events is recombination, whereby photons at high harmonics of the incident frequency are generated. In this talk we will discuss two tunneling toy models that combine to explain the beautiful physics that ensues in case the target molecule is prealigned. The first model describes bound-free electron tunneling and the second describes bound-bound rotational tunneling. Together, these models point to the information content of HHG from aligned molecules. In particular, our theory illustrates that harmonic signals map the rotational coherences of the aligned rotational wavepacket and probe the electronic continua of the molecule.