Probing Atomic Wavefunctions via Strong Field Light-Matter Interaction

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I will present an approach to perform correlated measurements of electronic wavefunctions and will describe how the correlated properties of the measurement can be applied to probe atomic states. The approach relies on the manipulation of an electron ion recollision process in a strong laser field [1]. We apply a two color field to direct the free electron's motion during one optical cycle (see Fig. 1A). Manipulating a recollision process allows us to resolve the symmetry of the atomic wavefunction with notably high contrast (see Fig. 1B).

The measurement, dictated by the strong laser field, provides a direct insight into its interaction with the atom. This approach will have an important impact on molecular tomography [2] and extend it to more complex molecular orbitals. Since the method is closely related with attosecond technology, time and space will combine in the future allowing dynamic imaging of a broad range of atomic and molecular processes.

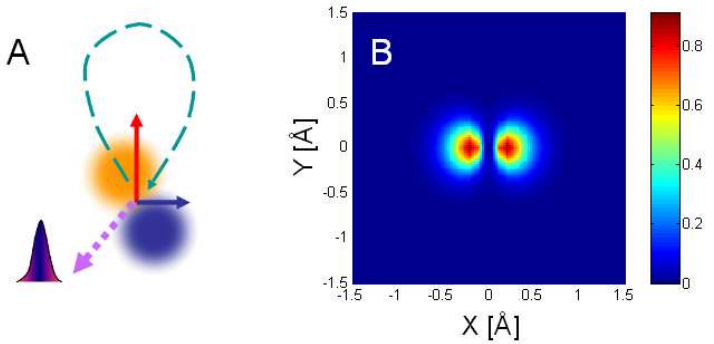

Figure 1: *A. Schematic drawing of attosecond pulse generation with a two color field. The motion of the electron is schematically described by the blue dashed line. The recollision projects the ground state into the optical frequencies of the emitted pulse. B. Retrieved Neon mixed* $2p$ *orbital.*

[1] P. B., Corkum "Plasma perspective on strong field multiphoton ionization", Phys. Rev. Lett. 71, 1994 (1993).
[2] J. Itatani et al. "Tomographic imaging of molecular orbitals", Nature 432, 867 (2004).