

Using Light to Control Electrons that in Turn Create New Light

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Intense light controlling ionizing electrons is at the heart of attosecond pulse generation. I will describe how pulse generation is influenced by the single electron structure of an atom or multi-electron dynamics; how perturbing the electron re-collision allows attosecond time delays to be measured and how these measurements are consistent with the three-step model of attosecond pulse generation.

Light control of electrons can also generate currents when a fundamental and its second harmonic are appropriately phased. These currents are a source term in Maxwell's equations, giving us precise control of the position, magnitude and direction of currents. We generate ring currents in semiconductors and ionizing gases and we use these currents to generate THz magnetic field transients, (including arrays of magnetic fields). The near-field structure of the THz B-field is very similar to a magnetic Skrymion. The radiated pulse will be electromagnetic flying tori.