Atomic dynamics beyond linearly-polarised light fields

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Attosecond science offers the prospect of investigating and potentially driving the electron cloud in a variety of systems. Maximum control over these dynamics can be obtained by setting up light fields such that the full 3d-motion of the electrons is steered. Linearly polarised light fields will not suffice for this task, and therefore the system of interest is investigated by using a variety of, for example, cross-polarised or elliptically/circularly polarized light fields.

Over the last 5 years, we have continued the development of the R-matrix with time dependence codes to provide capability for the description of atoms and molecules in arbitrarily polarized light fields [1]. This is of particular importance for molecular dynamics, as this flexibility is required when the molecule is not oriented along the laser field polarization [2].

The use of light fields with different polarization directions can be of interest to a variety of atomic dynamics. In pump-probe studies, orthogonal polarization directions between the pump and the probe can help eliminate interference from processes involving two-photon absorption by the pump or the probe. In RABBITT investigations, the polarization direction of the IR with respect to the XUV pulse train changes the interference between different pathways, and this may provide a more detailed perspective on the relative importance of different pathways leading to the same final state [3].

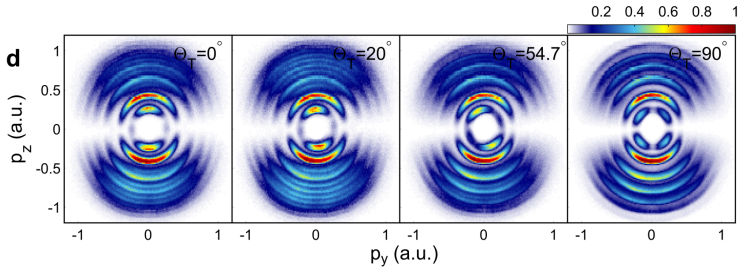

Figure 1: Changes in RABBITT sidebands via skewing the IR polarization vs. the polarization of the XUV pulse train [3].

References

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[2] J. Benda et al, Phys. Rev. A 102, 052826 (2020).
[3] W.Y. Jiang et al, Nature Comms. 13, 5072 (2022).