

## Quantum dynamics in structured photonic fields

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### Abstract

Phase- and polarization-textured laser pulses have been realized in a wide range of frequencies spanning the XUV to the THz regimes. This contribution presents few examples on how to use these pulses or combination thereof to induce new types of optical quantum transitions and/or laser-dressed states. For instance, it is found that electronic toroidal states can be triggered and controlled on the picosecond time scale using polarization-structured THz vector beams [1]. As well, micrometer size gas samples can be magnetized within femtoseconds using a combination of XUV pulse from a free-electron laser combined with an IR laser pulse carrying orbital angular momentum [2,3].

[1] J. Wätzel *et al.* Adv. Quantum Technol., 2: 1800096. <https://doi.org/10.1002/qute.201800096> (2019).

[2] J. Wätzel *et al.* Physical Review Letters (2022) at press.

[3] G. De Ninno *et al.* Nature Photonics 14, 554–558 (2020).