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Towards Observing Light-dressing Effects in Organic Molecular Crystals

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Quantum materials driven by strong laser fields can exhibit non-equilibrium electronic phases known as Floquet states, revealing a new domain of exciton light-matter interactions. By carefully designing the driver, it is possible to selectively excite or suppress Floquet modes, enabling enhanced control of the electronic dynamics. Floquet engineering has already been demonstrated in various non-organic systems, e.g. monolayer tungsten disulfide [1], black phosphorus [2], and cadmium selenide nanoplatelets [3]. In this work, we aim to directly observe strong-field driven light-dressing effects in organic molecular crystals through transient absorption spectroscopy. A mid-infrared strong-field pump pulse induces light-dressing effects in the sample and the dynamic excitonic response is probed by a broadband femtosecond pulse in the UV-visible spectral region. To improve signal-to-noise ratio, a dual cam referencing system is employed for spectral detection. In the future, we aspire to observe and identify strong-field effects in pentacene molecular crystals in dependence of the driving field polarization.

[1] Kobayashi, Y. *et al.*, *Nat. Phys.* **2023**, 19, 171-176.
[2] Zhou, S. *et al.*, *Nature* **2023**, 614, 75-80.
[3] Li, Y. *et al.*, *Nat. Photon.* **2024**, 18, 1044-1051.

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