Light-Matter Control of Quantum Materials: From Floquet states to cavity engineering

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Advances in time-resolved pump-probe spectroscopies have enabled us to follow the microscopic dynamics of quantum materials on femtosecond time scales. This gives us a glimpse into the inner
workings of how complex, emergent functionalities of quantum many-body systems develop on ultrafast
time scales or react to external forces. The ultimate dream of the community is to use light as a tuning
parameter to create new states of matter on demand with designed properties and new functionalities,
perhaps not achievable by other means. In this talk I will provide an overview of the field, highlighting
both ultrafast control of quantum materials [1] and the prospect of controlling materials with quantum
light in cavities [2].

[1] de la Torre, Kennes, Claassen, Gerber, McIver, MAS, Colloquium: Nonthermal pathways to ultrafast
control in quantum materials, Rev. Mod. Phys. 93, 041002 (2021)
https://journals.aps.org/rmp/abstract/10.1103/RevModPhys.93.041002
[2] Schlawin, Kennes, MAS, Appl. Phys. Rev. 9, 011312 (2022), Cavity quantum materials,
https://pubs.aip.org/aip/apr/article/9/1/011312/2835409/Cavity-quantum-materials