Controlling complex many-body states by time-periodic perturbations

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Abstract:

Using state of the art laser technology, one can probe condensed matter systems on the intrinsic timescale of their microscopic constituents. Observations like photo-induced metal-insulator transitions or photo-induced superconductivity raise the hope that complex material properties can be controlled within femtoseconds. In many cases even a qualitative understanding of the physical processes behind these photo-induced transitions is missing. In this talk I discuss recent developments of theoretical approaches based on the dynamical mean-field theory (DMFT) and its generalizations [1]. In particular, I will focus on the manipulation of states by time-periodic perturbations. Under the effect of periodic driving, many-body systems can synchronize into nontrivial time-periodic states [2], whose evolution can be understood in terms of a modified time-independent Hamiltonian. We show that in this sense, the electric field of a laser can be used modify the magnetic exchange interactions and thus control magnetically ordered states [3].

[1] H. Aoki et al., Rev. Mod. Phys. 86, 779 (2014).
[2] E. Canovi, M. Kollar, and M. Eckstein, arXiv:1507.00991.
[3] J.H. Mentink, K. Balzer, and M. Eckstein, Nature Comm. 6, 6708 (2015)