Max-Planck-Institut für Struktur und Dynamik der Materie

Max Planck Institute for the Structure and Dynamics of Matter

New: Thursday, July 15th, 2021 – 2 pm, Lecture I
Friday, July 16th, 2021 – 2 pm, Lecture II
Tuesday, July 20th, 2021 – 2 pm, Lecture III

Roberto Merlin

University of Michigan

A Series of Three Lectures on:

Floquet states, Rabi oscillations, Fermi's golden rule and all that

Rabi oscillations arise when a few-level quantum system is subjected to a periodically time-varying field while Floquet states are stationary solutions of a quantum system in the presence of a periodic time-dependent perturbation. Past the simplest derivations, students interested in these topics may miss to grasp the connection between Rabi oscillations and Floquet states beyond the obvious fact that they both involve a time-varying field. Equally important, they may struggle to find pedagogical accounts in the literature discussing the effect of dissipation, which is central to the interpretation of many physical phenomena. They may also ponder about the question as to how Rabi oscillations and Floquet states relate to results of time-dependent perturbation theory, particularly concerning Fermi golden rule and linear response theory.

In these series of lectures, aimed at students, we introduce an exactly solvable model of a two-level system coupled to a continuum, which interacts with a sinusoidally time-varying classical field. Results show that the behavior of the two-level system can be mapped onto the problem of a static field, if one shifts the energy separation between the two levels by an amount equal to the frequency of the field. This correspondence allows one to view Rabi oscillations and Floquet states from the different perspective of their time-independent-problem equivalents. The comparison between the rigorous results and those from perturbation theory helps clarify some of the difficulties underlying textbook proofs of Fermi golden rule, and the discussions on quantum decay and linear response theory.

Host: Andrea Cavalleri

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