ICFO

L4G SEMINAR: Unified framework on conductivities as a response to the time-dependent gauge field

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March 23, 2023
15:00 to 16:00
Blue Lecture Room & Online (Zoom)

Optical conductivity is one of the most important characteristics of materials. Nonlinear conductivities are of increasing experimental and theoretical interest recently, but the subject is largely open.
I will discuss our recent approach to the fundamentals of the nonlinear optical conductivities. An application of a spatially uniform electric field can be formulated as an insertion of Aharonov-Bohm flux. By considering the energy gain of the system in the two opposite limits of flux insertion --- adiabatic and sudden, we can derive the two renowned formulae on linear conductivities: Kohn formula for Drude weights and the f-sum rule, in a unified manner. Furthermore, they can be naturally generalized to all orders of nonlinear conductivities.
The Drude weight obtained from the nonlinear generalization of Kohn formula often turns out to be divergent. We argue that the divergence is due to the order of limits intrinsic to the Kohn formula, in which the adiabatic (zero frequency) limit is taken before the thermodynamic limit.
References:

Watanabe and M. O., Phys. Rev. B 102, 165137 (2020).
Watanabe, Y. Liu, and M. O., J. Stat. Phys. 181, 2050 (2020).
Takasan, M.O., and H. Watanabe, Phys. Rev. B 107, 075141 (2023).

This seminar is also hold online on Zoom.
Meeting ID: 823 2128 2565
Passcode: 27687
Hosted by: Maciej Lewenstein