Universität Bielefeld Fakultät für Physik

Physikalisches Kolloquium

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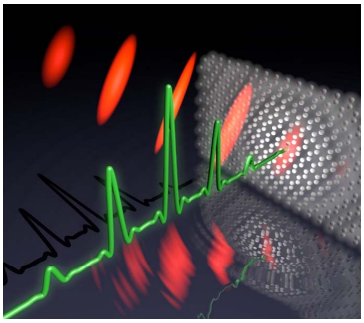
Coupling electrons and light in electron microscopy



The interaction of electrons and light is an integral part of our everyday experience. Microscopically, bound electrons in atoms and molecules can change their quantum state by absorbing and emitting photons. A free electron, however, cannot simply absorb a propagating photon, as the photon of a given energy does not carry sufficient momentum. In other words, energy and momentum conservation cannot be simultaneously fulfilled in this process. However, if the light field is confined to subwavelength dimensions, the situation dramatically changes: Electrons passing through an optical near field can both emit and absorb multiple photon energies, creating discrete energetic sidebands in the electron spectrum. This mechanism is at the heart of recent developments combining optical spectroscopy with electron microscopy.
In this talk, I will introduce basic principles and selected applications of inelastic electron-light scattering in electron microscopy. Besides the nanoscale imaging of optical fields, the mechanisms described allow for a coherent control of the electron quantum state, spatial and temporal electron beam manipulation, and the preparation of attosecond electron bunches. Finally, recent progress in the coupling of electron beams to whispering gallery mode resonators and related future prospects will be discussed.

Monday, 14.06.2021, 16:15 Uhr
via zoom