

Lighthouse Lightning Talk - Free-Electron States as Ultrafast Probes for Qubit Dynamics in Solid-State Platforms (7'+3')

Thursday 29 June 2023 10:10 (10 minutes)



Figure 1: Speaker –Sascha Schäfer

Abstract

In the past, the preparation and selective observation of well-defined states of solid-state quantum systems often relied on their interaction with light. However, light has a series of disadvantages, including large foci and typically weak light-matter coupling. In recent years, we demonstrated the coherent coupling of free-electron states to localized light states utilizing the unique capabilities of ultrafast transmission electron microscopy and allowing for a coherence transfer between light and electrons. In this approach, the involved light and plasmonic fields were excited deeply in the classical regime, so that only quantum coherent dynamics of the free electron states were observed, and quantum aspects of the solid-state nanostructure were not essential for the physics involved.

In the MQV Lighthouse project “Free-electron states as ultrafast probes for qubit dynamics in solid-state platforms”, we want to extend this line of research to the interaction of electrons with nanoscale solid-state quantum systems, including localized exciton states in transition metal dichalcogenides and quantum dots. A crucial element in an efficient coupling will involve a tailoring of the photonic environment by TEM-compatible resonator structures which allow for a local enhancement of the electron evanescent field at the position of the quantum system.

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Session Classification: Quantum Hardware