## Seminar/Talk

# Interfacing free electrons and light using photonic integrated circuits

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Host: Johannes Fink

Quantum optics studies how photons interact with other forms of matter, the understanding of which was crucial for the development of quantum mechanics as a whole. Starting from the photoelectric effect, the quantum property of light has led to the development of atomic physics, laser science, and nonlinear optics. Free-electron quantum optics studies the fundamental interaction between a flying electron and quantum optical fields. The semi-classical interaction between free electrons and an intense laser field has been well studied, but the quantum nature of light remains elusive. Coherent cathodoluminescence, by its energy-conserved nature, can reveal the quantum nature of electron-light interaction under the right measurement setting. In this talk, we discuss the theoretical basis of the quantum optical interaction between free electrons and light, as well as the experimental platform we developed using integrated photonic circuits. With a classical laser field, we observe efficient stimulated free-electron interaction with both linear and nonlinear optical fields, as well as spatial features not directly accessible using optical means. When the cavity is in a vacuum state, the quantum nature of electron-photon interaction is revealed in the form of coherent cathodoluminescence by analyzing the correlations of particle coincidence, thanks to complete control over the input-output ports of the used photonic device, as well as event-based electron detectors.

**Thursday, January 11, 2024 01:30pm - 02:30pm**
Office Bldg West / Ground floor / Foyer seminar room (I21.EG.128)

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