Electron – Photon Pairs in Transmission Electron Microscopy

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Electron microscopy is a highly developed technology that employs the wave properties of electrons to resolve structures at an atomic level.
In this work we investigate coherent cathodulmenescene (CL) photons and their corresponding electrons in a time-resolved coincidence measurement on the single particle level.
Within a transmission electron microscope, a thin silicon membrane is illuminated by a collimated electron beam. The emitted CL photons are (wavelength sensitive) detected using single photon counting modules and time-stamped. The coincident electrons are detected in image and momentum space (using a Timepix3 detector). Such measurement scheme allows us to study momentum-position correlation.
The investigation of correlated electron-photon pairs may reveal exciting new phenomena and open a path to electron-photon coincidence experiments inspired by photonic quantum optics.