

Joint PhD position proposal:

Shaping Quantum Wavefunctions in Electron Microscopes

Project Overview

We propose a joint Jülich ER-C/Technion position for a PhD student to develop a laser-based spatial electron phase modulator.

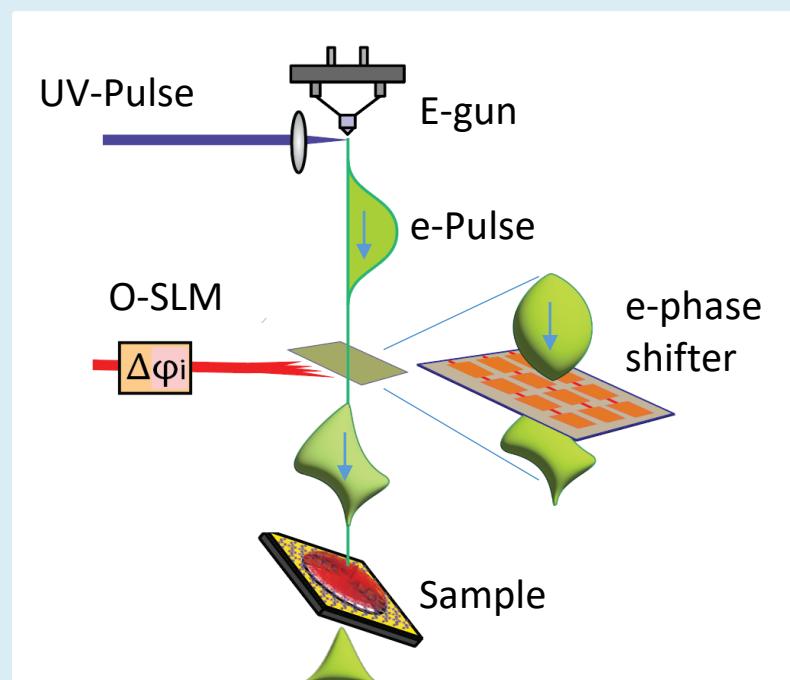
In building such a device, we aim to harness electron coherence as a key method for lowering the required electron dose in imaging of dose-sensitive materials using high-end electron microscopes.

Cutting-edge interferometric techniques necessitate precise manipulation of the electron wavefunction and its phase front. Mastering dynamic control over this phase front represents a significant yet unresolved challenge, promising substantial advancements in the field.

The modulator we will build takes advantage of the phase shift gained by the electron wavefunction when traversing built-in electric fields in semiconductor devices, such as PN or Schottky junctions. These devices will be externally controlled by laser beams for dynamic, ultrafast operation as schematically described in the figure.

What You Will Do

- Design and simulate devices for laser-controlled electron wavefront shaping
- Perform TEM experiments to test and validate the device performance
- Harness the device for novel scientific demonstrations empowered by the use of a controlled electron wavefront
- Develop and apply light-assisted contrast mechanisms inside the microscope
- Analyze electron microscopy data to extract functional information
- Conduct extended research stays at Germany and Israel and collaborate internationally



Laser-control of quantum wavefunctions in transmission electron microscopy. The PhD student will build a spatial electron phase modulator, where each “pixel” independently shifts the local phase of the electron wavefunction.

Candidate Profile

Applicants should hold a BSc or MSc in Physics, Materials Science, or a related field, and be excited about tackling physics-driven questions using advanced microscopy.

Prior experience in electron microscopy or optics is **not required**, but a plus.

Research Environment

The Ernst Ruska-Centre for Microscopy (ER-C) in Jülich is the German national center of excellence in high-end electron microscopy, and the world’s largest and most advanced electron microscopy center.

The AdQuanta group at Technion is one of the world leaders in ultrafast electron microscopy. The group develops unique theoretical and experimental capabilities for exploring novel kinds of electron-photon interactions.

How To Apply

Reach out to interview for this PhD program and get to work in leading laboratories in Israel and Germany. On top of a full PhD fellowship, the position includes a special housing allowance and substantial support for frequent international travels between Germany and Israel.

To apply, kindly forward your CV and a motivation letter to kaminer@technion.ac.il and a.tavabi@fz-juelich.de. Acceptance to the program necessitates successful interviews at both Technion and Jülich.