

Marius Chirita-Mihalia



TU Wien, IAP, FB Atom- und Plasmaphysik

Tuesday, 10th January 2023, 16:00 s.t.

TU Wien, Institut für Angewandte Physik, E134

1040 Wien, Wiedner Hauptstraße 8-10

Yellow Tower „B“, 5th floor, SEM.R. DB gelb 05 B



Electrons meet light

The precise transverse control of electrons is at the heart of any high-resolution electron microscope where electron lenses and multipole aberration correctors have enabled sub-Angström spatial resolution.

This work describes a novel way of achieving transverse control over the electrons [1]. In the specimen chamber of a modified ultrafast scanning electron microscope, the electron pulse interacts in free space with a shaped counterpropagating laser pulse, inducing on-demand phase shifts to the electron wave. We demonstrate convex and concave light-based electron lensing, whereas concave lensing is impossible with traditional magnetostatic lenses. Furthermore, we show that we can create arbitrary electron intensity patterns. In contrast to other competing electron-shaping technologies, the light-based method is programmable and avoids losses, inelastic scattering, and instabilities due to the degradation of material diffraction elements. In the future, parts of the electron microscopes might be made of optical systems to improve the resolution and contrast of electron images.

Marius Constantin Chirita Mihaila is a postdoc in the group of Richard Wilhelm at IAP/TU Wien, where he works on experiments with ultrashort pulsed ions. He did his undergraduate and graduate studies at the Faculty of Physics, University of Vienna. His master's thesis was conducted with Eberhard Widmann at the Stefan Meyer Institute for subatomic physics, and his doctoral research with Thomas Juffmann in the Quantum Optics group and Max Perutz Labs.

[1] M.C.C. Mihaila *et al.*, *Phys. Rev. X* **12**, 031043 (2022)

All interested colleagues are welcome to this seminar lecture
(45 min. presentation followed by discussion).

Friedrich Aumayr
(LVA-Leiter)

R.A. Wilhelm
(Seminar Chair)