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Tuesday, 6th Dezember 2022, 16:00 s.t.

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1040 Wien, Wiedner Hauptstraße 8-10
Yellow Tower „B“, 5th floor, SEM.R. DB gelb 05 B



From information theory to novel imaging techniques

Various imaging and scattering techniques rely on the measurement of phase shifts. Prominent examples include quantitative phase microscopy, holography, X-ray scattering, and cryo-electron microscopy. We discuss these techniques in terms of Fisher information and associated Cramer-Rao bounds, enabling us to calculate the achievable measurement sensitivity for a given technique. These calculations are especially important in electron microscopy, where electron-induced specimen damage forces us to work at a low dose, where information per electron becomes a crucial figure of merit. We discuss electron wavefront shaping as a possible way to reduce damage in electron microscopy and show experiments that demonstrate wavefront shaping via electron-light interactions. Finally, we discuss a novel hybrid imaging technique, in which optical near-fields are imaged using a low-energy electron microscope. The technique avoids electron-specimen interactions altogether and might provide an alternative for applications that require label and damage-free, imaging with $\sim 10\text{nm}$ resolution.

Fundamental Bounds on the Precision of Classical Phase Microscopes, D. Bouchet, J. Dong, D. Maestre, and T. Juffmann, *Phys. Rev. Appl.*, 15(2), 024047 (2021)

Local Optimization of Wave-fronts for optimal sensitivity PHase Imaging (LowPhi), T. Juffmann, A. De los Rios Sommer, S. Gigan, , *Optics Communications*, 454, 124484 (2020).

Transverse electron beam shaping with light, M. C. Chirita Mihaila, P. Weber, M. Schneller, L. Grandits, S. Nimmrichter, T. Juffmann, *Phys. Rev. X* 12, 031043 (2022).

Optical Near-Field Electron Microscopy, R. Marchand, R. Šachl, M. Kalbáč, M. Hof, R. Tromp, M. Amaro, S. J. van der Molen and T. Juffmann, *Phys. Rev. Applied* 16, 014008 (2021)

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

Friedrich Aumayr
(LVA-Leiter)

Wolfgang Werner
(Seminar Chair)