

Institut für Festkörperphysik

Abteilung Atomare und Molekulare Strukturen



# Vortragsankündigung

**Montag, den 04.11.2024  
um 10:00 Uhr  
LNQE - Seminarraum 001  
Schneiderberg 39**

spricht

## **Prof. Dr. Juergen Czarske**

Full Professor at Faculty Electrical and Computer Engineering, School of Engineering and Coopted  
Professor of Faculty Physics, School of Science, Director of Center for Biomedical Computational  
Laser Systems (BIOLAS) and Institute for Systems and Circuits,  
TU Dresden, Germany,

Adjunct Professor of Optical Sciences, Wyant College of Optical Sciences,  
University of Arizona, Tucson, USA

Recipient of 2024 SPIE Dennis Gabor Award in Diffractive Optics

zum Thema

**“Physics-informed deep neural  
networks for multimode fiber  
information transmission towards  
classical and quantum communication”**

### Abstract

Optical fibers are the backbone of internet. Quantum Key Distribution (QKD), a transmission of keys that are sent between Alice and Bob, achieves security based on quantum mechanics. Entanglement was outlined by Einstein et al. and leading to nonlocal correlations for teleportation in communication (spooky action at a distance). Due to the non-cloning theorem secure data transmission is guaranteed. However, the key rate is many orders of magnitude lower than in classical communication systems. Multimode fibers show promise for improving data rates, but come with the challenge of compensating for scattering effects due to mode conversions. Physics-informed deep learning enables to correct the mode scattering. Perspectives for quantum communication will be discussed.

“Multimode Optical Interconnects on Silicon Interposer Enable Confidential Hardware-to-Hardware Communication”, Sensors, 2023, mdp

“Lensless fiber endomicroscopy in biomedicine”, Perspective, PhotonicX of Nature, 2024

“AI-driven projection tomography with multicore fibre-optic cell rotation”. Nature Communications, 15, (2024)

“Securing Data in Multimode Fibers by Exploiting Mode-Dependent Light Propagation Effects”, Research, (2023)

“Quantitative phase imaging through an ultra-thin lensless fiber endoscope”, Light: Science and Applications of Nature Publishing (2022)

“Intensity-only Mode Decomposition on Multimode Fibers using a Densely Connected Convolutional Network”, IEEE/OSA Journal of Lightwave Technology, (2021)

### Biography:



**Juergen Czarske** received PhD degree in engineering and physics from Leibniz University, Germany. Juergen (Fellow EOS, OPTICA, SPIE, IET, IOP, Senior Member IEEE) is director, full chair professor and senator of the TU Dresden, Germany. His awards include the 2008 Innovation Prize of Trumpf, 2019 OPTICA Joseph-Fraunhofer-Award/Robert-M.-Burley-Prize, 2020 Laser Instrumentation Award of IEEE Photonics Society, 2020 and 2021 SPIE Community Champion for volunteer activities, and 2022 SPIE Chandra S Vikram Award. He fosters talented students early. The students and members of his lab have won over 125 prizes, awards and honors, including Bertha-Benz award of Daimler Benz Foundation (10,000 Euro).

He was Vice President of International Commission for Optics, ICO, and was the general chair of the world congress ICO-25-OWLS-16-Dresden-Germany-2022 (two times postponed), which was co-sponsored by OPTICA, SPIE, IEEE, Zeiss, DGaO-The German Branch of EOS, IUPAP, TUD and City of Dresden. 3 Nobel laureates delivered plenary lectures and the participants came from 55 countries (5A: America, Asia, Australia, Africa and Amazing Europe).