



# Münchner Physik- Kolloquium

Sommer  
2022

## Beyond structure and composition: Multidimensional TEM as a key for imaging electric fields, 3D shape and soft matter

**Prof. Dr. Knut Müller-Caspary**, *Ludwig-Maximilians-Universität München*

Monday, 9 May 2022, 17:15 h

Hörsaal 2, Physik-Department der TUM, James-Franck-Straße 1, Garching

■ Neben der Veranstaltung vor Ort sind die Vorträge in diesem Semester auch als Videoübertragung im Internet verfügbar: <https://tum-conf.zoom.us/j/93234766313>  
Meeting-ID: 932 3476 6313; Password: Kolloquium; Please install the software in advance.

In recent years, the dimensionality in transmission electron microscopy (TEM) has increased rapidly by the advent of ultrafast cameras that record at frame rates of many kHz. This development has especially paved the way for a revolution as to the versatility of scanning TEM (STEM). In particular, momentum-resolved STEM enhanced traditional Z- and phase-contrast techniques such that any conventional imaging mode is present simultaneously in a 4D data set. Most importantly, the combination of real- and reciprocal space information nowadays allows to quantify charge densities with subatomic resolution, to measure polarisation-induced electric fields, and to solve the phase problem by ptychographic techniques. This presentation includes a brief review of quantitative STEM, followed by selected works on ultrafast detectors. We demonstrate the capability of 4D-STEM using several examples such as the mapping of atomic electric fields in 2D materials and ptychographic reconstructions using different algorithms. The talk closes with prospects on ultrahigh time resolution for imaging (magnetic) dynamics at GHz frequencies, and opportunities for high-contrast imaging of soft matter at low doses, building a bridge between materials science methodology and life science challenges.

## Student event: Meet the speaker

We invite you to a **student-only** discussion-round with Prof. Dr. Knut Müller-Caspary before his Munich Physics Colloquium talk.

Be curious and feel free to ask any question.

Monday, 9 May 2022, 16:00 h,

Seminar room PH 3268 (upper floor), Physik-Department der TUM, James-Franck-Straße 1, Garching

