

# Allgemeines Physikalisches Kolloquium

Donnerstag, 21.05.26 – 16 Uhr c.t.

IG1 – HS 2 | Wilhelm-Klemm-Str. 10

Kolloquiums-Kaffee ab 16 Uhr vor dem Hörsaal

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## The power of scanning transmission electron microscopy in materials science and engineering

Atomic scale structure analysis is essential for understanding properties, behaviour and performance of advanced materials and devices. One of the most powerful tools to unravel the atomic scale structure of materials is (scanning) transmission electron microscopy (S/TEM). The last decades have seen spectacular developments in S/TEM particularly driven by aberration correctors that now allow real space structure analysis with unprecedented spatial resolution (e.g. 50 pm) and also allow spectroscopic analysis at the atomic scale. Moreover, new opportunities have become available for performing in-situ experiments without compromising much on the spatial resolution. This is due to the development of a wide range of (MEMS-based) in-situ holders for e.g. heating, cooling, electrical biasing, and exposure to gases or liquids. This has opened up new avenues for materials research where S/TEM is not only powerful because it can take static snapshots with uniquely high resolution, but also because it can reveal rich dynamic behaviour.

In this presentation a few examples are given where we exploited new capabilities of S/TEM: imaging for the first time (1) hydrogen atoms [1], (2) reversible oxygen ions migration by in-situ electrical biasing [2] and (3) recording atomic resolution movies of monolayer WS<sub>2</sub> at ultra-low accelerating voltages [3].

[1] S. de Graaf et al., Science Advances 6, eaay4312 (2020)

[2] P. Nukula et al., Science 372, 630-635 (2021)

[3] S. de Graaf et al., Nanoscale 13 (48), 20683-20691 (2021); S. de Graaf et al. 2D Materials 9, 015009, (2021)