



TECHNISCHE UNIVERSITÄT  
IN DER KULTURHAUPTSTADT EUROPAS  
CHEMNITZ

# Institut für Physik

## Physikalisches Kolloquium



**Donnerstag, 06.06.2024, 15:30 Uhr**

**Ort: Reichenhainer Str. 90;**

**Zentrales Hörsaal- und Seminargebäude, Raum C10.013**

**Prof. Dr. Georg von Freymann**

Physics Department and Research Center OPTIMAS,  
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### Terahertz spectroscopy and quantum sensing

**Most spectroscopy setups working in the terahertz frequency range are based on time-domain spectroscopy requiring ultrafast lasers and suitable delay units. After a short introduction into industrial terahertz applications, I will demonstrate that for terahertz spectroscopy neither ultrashort lasers nor terahertz emitters and detectors are in principle necessary: Terahertz sensing with nonlinear interferometers [1] is based on spontaneous parametric down-conversion (SPDC) and the concept of induced coherence without induced emission [2]. Visible pump photons from a continuous wave laser are converted via SPDC into a biphoton state. One of the two photons is in the terahertz spectral region the other one ideally in the visible spectral region. Each photon travels in one arm of the interferometer. The sample under investigation is placed in the arm in which the terahertz photon propagates. Interaction with the sample is transferred to the visible photon, which is detected with conventional silicon-technology based detectors. [1,3,4].**

**I will close with an outlook how to transfer this quantum approach to classical non-linear optics to reach industry compatible measurement times [5].**

#### References

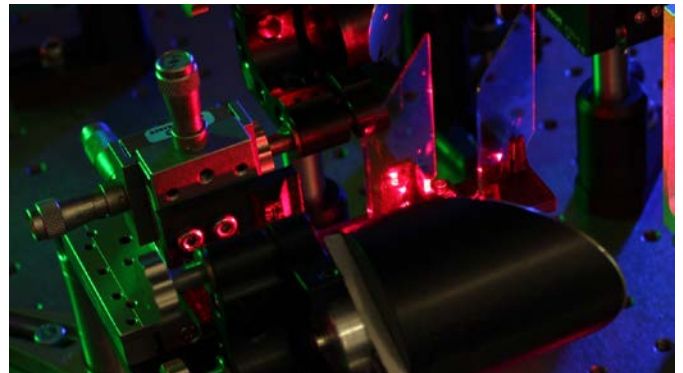
[1] Mirco Kutas, et al., Terahertz Quantum Sensing, *Science Advances* 6, eaaz8065 (2020)

[2] L. J. Wang, et al., Induced coherence without induced emission, *Phys. Rev. A* 44, 4614 (1991)

[3] Mirco Kutas, et al., Quantum-inspired terahertz spectroscopy with visible photons, *Optica* 8, 438 (2021)

[4] M. Kutas, et al., Quantum sensing with extreme light, *Advanced Quantum Technologies* 5, 2100164 (2022)

[5] T. Pfeiffer, et al., Phase-sensitive terahertz upconversion detection, *Optics Express* 30, 27572 (2022)



Alle Zuhörer sind ab 15:15 Uhr zum Kaffee vor dem Hörsaal eingeladen.

Informationen zum Vortrag erteilt:  
Prof. Dr. Ulrich T. Schwarz, Tel. 0371 531 30001



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