TECHNISCHE UNIVERSITÄT
IN DER KULTURHAUPTSTADT EUROPAS
CHEMNITZ

Institut für Physik
Physikalisches Kolloquium

Donnerstag, 06.06.2024, 15:30 Uhr

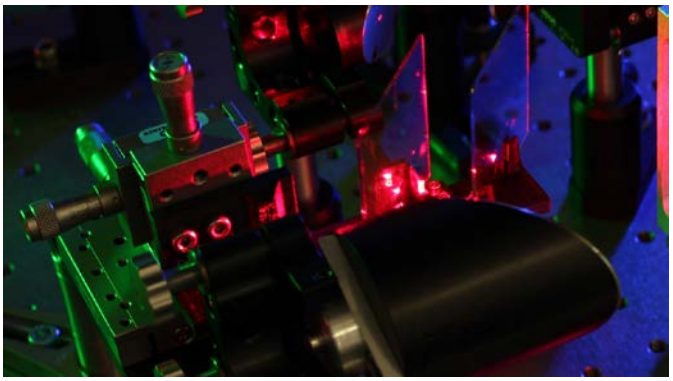
Ort: Reichenhainer Str. 90;
Zentrales Hörsaal- und Seminargebäude, Raum C10.013

Prof. Dr. Georg von Freymann

Physics Department and Research Center OPTIMAS,
Rheinland-Pfälzische Technische Universität Kaiserslautern-Landau,
Fraunhofer Institute for Industrial Mathematics ITWM, Kaiserslautern,

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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