# Seminarankündigung

## Dienstag, 7. Dezember 2021
## 13:00 Uhr

## WSI, Seminarraum S 101
**also ONLINE via ZOOM**
https://tum-conf.zoom.us/j/63210679333
Meeting-ID: 632 1067 9333
Kenncode: 075076

# "Nonlinear optics in atomically thin materials"

Nonlinear optics is of paramount importance in several fields of science and technology: it is commonly used for frequency conversion, self-referencing of frequency combs, sensing, and ultra-short pulse generation and characterization. Large efforts have been devoted in the last years to realizing electrical and all-optical modulation of the nonlinear optical response of atomically thin materials, which are easy to integrate on photonic platforms and thus ideal for novel nanoscale devices [1-2]. In this talk, I will present two approaches to achieve large modulation of the harmonic generation in graphene and in transition metal dichalcogenides (TMDs). The first method is based on the electrical control of the graphene's Fermi energy. This allows to tune the nonlinear multi-photon resonances occurring within the Dirac cone and thus to achieve a large electrical modulation of the third harmonic generation [2]. The second example regards a new approach for broadband all-optical modulation of the second harmonic generation. The concept is based on symmetry considerations and thus it is applicable to any material of the D3h symmetry group and with deep sub-wavelength thickness, such as all monolayer TMDs. With this approach we demonstrated a 90° rotation of the second harmonic polarization on a time-scale limited only by the fundamental pulse duration. In addition, this ultrafast polarization switch can be immediately applied to realize all-optical second harmonic amplitude modulation [3]. Finally, I will discuss an application of gate-tuneable optical nonlinearities in graphene. In particular, I will show how four wave mixing on a hybrid graphene/D-shaped fibre device can be used for gas sensing with single-molecule sensitivity [1].

[1] N. An et al., Nano Letters 20, 6473 (2020).
[2] T. Tan et al., Nature Communications 12, 6716 (2021)
[2] G. Soavi et al., Nature Nanotechnology 13, 583 (2018).
[3] S. Klimmer et al., Nature Photonics 15, 837 (2021)

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