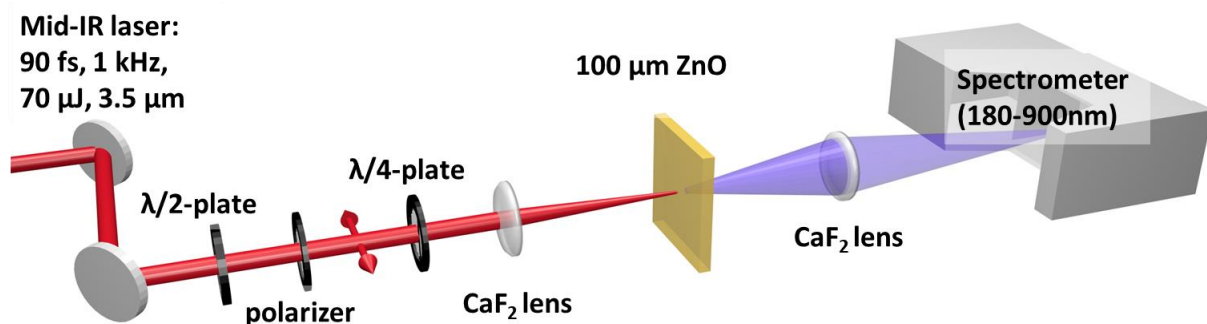


# Ellipticity dependence of high harmonic generation in condensed matter

High-order harmonic generation (HHG) in crystalline bulk semiconductors originates from nonlinear intraband currents and interband transitions of the electrons driven by the strong mid-IR electric field. In contrast to HHG in gases high order harmonics can be observed from condensed matter for elliptically polarized driving fields [1]. It has been predicted theoretically, the HHG signal for varying laser pulse ellipticity depends on the pulse intensity and harmonic order [2]. Furthermore, from the ellipticity dependence of each individual harmonic order we want to gain a deeper understanding of dynamics of the electronic structure of semiconductor materials [2].

In this project the dependence of the HHG signal from intense femtosecond mid-IR laser pulses in ZnO samples will be investigated experimentally. The students work comprising the following tasks:

- Lab work: Set up experiments in our novel femtosecond laser lab.
- Implementation of all necessary lab software in LabView.
- Data acquisition and processing.



Experimental setup: The pulses from a femtosecond high power mid-IR laser source are attenuated using a  $\lambda/2$ -plate and a polarizer. With a  $\lambda/4$ -plate the ellipticity dependence of HHG radiation from a 100 μm thick ZnO sample is measured.

## Literature:

- [1] N. Yoshikawa, T. Tamaya and K. Tanaka. "High-harmonic generation in graphene enhanced by elliptically polarized light excitation". *Science* 356, 736 (2017)
- [2] C. Liu, Y. Zheng, Z. Zeng and R. Li. "Effect of elliptical polarization of driving field on high-order-harmonic generation in semiconductor ZnO" *Physical Review A* 93, 043806 (2016)

## Contact for further information or application:

Richard Hollinger (richard.hollinger@uni-jena.de)

Prof. Christian Spielmann (christian.spielmann@uni-jena.de)