Walther-Meißner-Institut

Bayerische Akademie der Wissenschaften

Walther-Meißner-Seminar

Walther-Meißner-Institut, Seminar Room 143

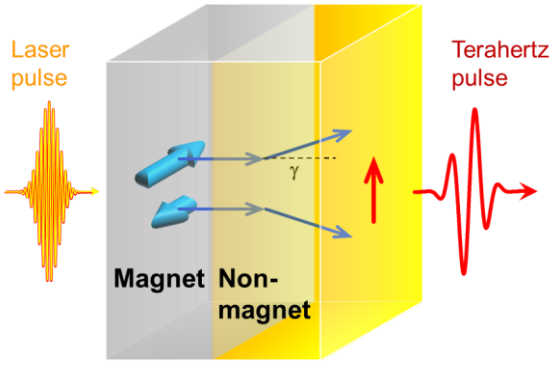
Date: **Friday 13, January 2017, 13:30 h**

Speaker: **Dr. Tobias Kampfrath**

Fritz Haber Institute, Berlin, Germany

Title: **Ultrafast spintronics with terahertz radiation**

Abstract:
Terahertz (THz) electromagnetic radiation is located in the gap that separates the realms of electronics (<1 THz) and optics (>30 THz). Sub-picosecond THz pulses are capable of probing and even controlling numerous low-energy excitations of condensed matter, for instance phonons, excitons and Cooper pairs. Here, we consider experiments showing that THz radiation is also a very useful and versatile tool in the fields of spintronics and ultrafast magnetism.



First, we optically launch femtosecond spin transport and study its conversion into charge currents by means of the inverse spin Hall effect [Nature Nanotech. 8, 256 (2013)]. The charge current can be detected by sampling the concomitantly emitted THz radiation. This approach allows us to monitor ultrafast spin currents and provides a quick and easy estimate of the strength of the spin Hall effect in a contact-free manner. In addition, optimization of the spintronic structure has led to new, efficient and scalable emitters of THz pulses that fully cover the range from 1 to 30 THz without gap [Nature Photon. 10, 483 (2016)].

Second, to address the coupling of crystal lattice and electrons spins, we selectively excite optical phonons in the model ferrimagnetic insulator Y3Fe5O12 (YIG). We find a quenching of magnetic order on a time scale as short as 1 ps. This observation attests to a highly efficient coupling of crystal lattice and electron spins in this material. It suggests that the spin Seebeck effect is operative even at THz frequencies.

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