GOETHE UNIVERSITÄT
FRANKFURT AM MAIN

Fachbereich Physik
Institut für Theoretische Physik

CONDENSED MATTER THEORY SEMINAR

Subject: **Floquet topological phases with ultracold atoms in periodically-driven lattices**

Speaker: **Prof. Dr. Monika Aidelsburger (Fakultät für Physik, Ludwig-Maximilians-Universität München & Munich Center for Quantum Science and Technology (MCQST))**

Date & time: **Friday, December 13th, 2019 at 3:15 p.m.**

Venue: **Seminar room 1.114**

Topological phases of matter exhibit remarkable electronic properties that offer unique possibilities for applications. A prominent example is the robust quantization of the Hall conductivity in quantum Hall insulators. A widespread technique for generating topological band structures in synthetic systems, such as ultracold atoms in optical lattices, is Floquet engineering [1]. This method relies on the periodic modulation of the system's parameters to emulate the properties of a non-trivial static system and facilitated the realization of two paradigmatic topological lattice models: the Hofstadter and the Haldane model. Moreover, it inspired ideas for implementing complete lattice gauge theories [2].

The rich properties of Floquet systems, however, transcend those of their static counterparts [3]. The associated quasienergy spectrum can exhibit a non-trivial winding number, which leads to the appearance of anomalous chiral edge modes even in situations where the bulk bands are topologically trivial, hence, altering the well-known bulk-edge correspondence. A full classification of Floquet phases requires a new set of topological invariants. Here, I will report on recent results, where we have studied the rich Floquet phase diagram of a periodically-modulated honeycomb lattice using bosonic atoms. The novel properties of anomalous Floquet phases mentioned above open the door to exciting new non-equilibrium phases without any static analogue.

[1] A. Eckardt, Phys. Mod. Phys. 89, 311 (2017)
[2] C. Schweizer *et al.*, Nat. Phys. (2019); L. Barbiero *et al.*, Science Advances 5, eaav744 (2019)
[3] T. Kitagawa et al., Phys. Rev. B 82, 235114 (2010)