UNIVERSITÄT DUISBURG ESSEN

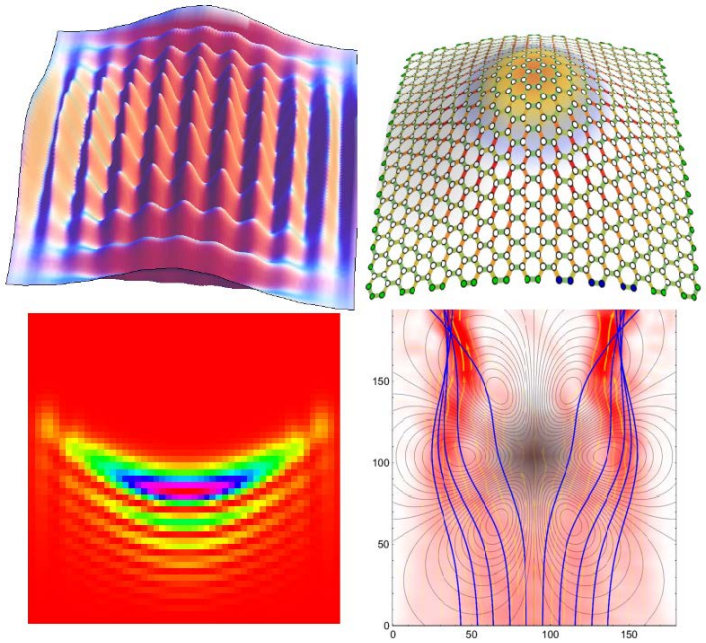
PHYSIK E=

# Physikalisches Kolloquium

**Mittwoch, 28.11.2018**
**13:00 Uhr**
**Hörsaal MC 122**

## Quantum simulation of strong curvature and gauge fields in optical and crystalline systems

Dr. Nikodem Szpak
Fakultät für Physik, UDE




We present our work on a new type of quantum simulators for relativistic quantum fields living in curved spaces. They are based on discrete physical systems with lattice geometry, like crystals or optical lattices, and various types of perturbations of their regular structure. Formulation of their effective description in terms of continuous fields, obtained by the application of discrete differential geometry and continuous theory of defects, leads to effective models of quantum fields coupled to emergent gauge fields and curved spaces. Optical lattices and graphene represent, due to their high structural flexibility, the most natural areas of application for these ideas. On the one hand, they offer access to ultra-strong fields not accessible in present experiments and help to study strong field phenomena, like Schwinger pair creation or Hawking radiation. On the other hand, they provide an efficient tool for designing new types of nanodevices based on electron optics or valleyronics which can be used for ultra-sensitive measurements.