Einladung zum Physikalischen Kolloquium
Sommersemester 2022

Physikzentrum der Technischen Universität Braunschweig

Mendelssohnstraße 2/3, Hörsaal MS 3.1, 16:45

Pascal Puphal

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will give a talk on

July 5th, 16:45, MS 3.1

Controlling physical ground states

While condensed matter theory predicts many exotic ground states as Bethe strings, Weyl fermions, Dirac electrons, topological order, various quantum spin liquid kinds, experimental evidence often lacks behind or is missing entirely as it requires the corresponding materials in ideal form as single crystals.

By manipulating the crystalline lattice via a crystal engineering approach by a combination of chemical pressure and topochemistry, I experimentally control fundamental properties of single crystals, synthesized in the group, such as the magnetic exchange interactions and conductivity to create new states of matter. Candidates discussed in the Colloquium will turn around the Cu^{2+} kagome lattice and Ni^{1+} square lattice systems (infinite-layer nickelates). After introduction of the range of other means of control via chemical substitution, i.e. chemical pressure and or effective doping, as well as external pressure, magnetic fields or optical pumping, I will move on to the future prospects of topochemical control. For cuprates, I will show that a quantum spin liquid ground state can be created simply by controlling the disorder in these systems and show future prospects of creating a strongly correlated Dirac metal [1]. While the nickelates realize a unique example, where targeted materials design via topotactical means has already been proven to host superconductivity similar to cuprate superconductors, this was done so far only on thin films [2]. Here, I will present our advances for bulk infinite layer nickelates.

[1] I. I. Mazin et al., Nature Communications **5**, 4261 (2014).

[2] D. Li et al., Nature **572**, 624–627 (2019)