GOETHE UNIVERSITÄT FRANKFURT AM MAIN

Fachbereich Physik
Institut für Theoretische Physik

# CONDENSED MATTER THEORY SEMINAR

Subject: **First-order topological phase transitions with correlated electrons**

Speaker: **Prof. Dr. Giorgio Sangiovanni, Universität Würzburg**

Date & time: **Friday, July 12th, 2019 at 3:15 p.m.**

Venue: **Seminar room 1.114**

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When the bandstructure of a topologically trivial insulator evolves into that of a quantum spin Hall, the gap closes and inverts gradually. The situation can drastically change if the electrons experience a strong Coulomb repulsion. The second-order phase transition turns into a discontinuous one and the system eschews to be fine-tuned to a gapless semimetal [1].
In this talk I am going to show that two-orbital microscopic models for two- and three-dimensional topological insulators display a first-order phase transition. This originates from the asymmetry resulting from the rapid growth of the many-body character on the non-trivial side, while the band insulator persists in its Hartree nature [1, 2]. This blending between non-trivial topology and local orbital physics is the key physical ingredient which allows us to define local observables diverging at the quantum critical point.

The boundary modes in the topologically non-trivial phase are influenced by the presence of the high-spin Mott insulating phase at even larger values of U. We indeed observe a boundary reconstruction in 2D: the edge states get gapped out in the outmost part of the slab and settle in sub-peripheral layers [3]. Upon allowing for time-reversal symmetry breaking this turns into an interesting coexistence of correlated metallic modes and antiferromagnetism [4].

References

[1] A. Amaricci, J. C. Budich, et int., G. Sangiovanni, Phys. Rev. Lett. 114, 185701 (2015)
[2] A. Amaricci, J. C. Budich, et int., G. Sangiovanni, Phys. Rev. B 93, 235112 (2016)
[3] A. Amaricci, L. Privitera, et int., B. Trauzettel, Phys. Rev. B 95, 205120 (2017)
[4] A. Amaricci, A. Valli, et int., M. Capone, Phys. Rev. B 98, 045133 (2018)