PAUL SCHERRER INSTITUT

PSI

CONDENSED MATTER THEORY SEMINAR

Anomaly Manifestation of Lieb-Schultz-Mattis Theorem and Topological Phases

Dr. Chang-Tse Hsieh, ISSP, University of Tokyo

Thursday, Oct 11, 2018, 14:00-15:00

WHGA/121 (PSI-West)

Abstract:

The Lieb-Schultz-Mattis (LSM) theorem dictates that any one-dimensional electronic lattice system cannot be a trivial symmetric insulator if the filling per unit cell is not integral and if the lattice translation symmetry and particle number conservation are strictly imposed. In this talk, I will make a comparison between such one-dimensional metallic (gapless) states enforced by the LSM theorem and the boundary gapless states of one-higher dimensional symmetry-protected topological (SPT) phases, from the perspective of quantum anomalies. These two kinds of systems are the rare circumstances where the emergent structures of many-body systems are largely constrained by microscopic kinematic data such as symmetries and spatial dimensions. While at low-energy they are both described by the same effective field theory with the same effective symmetry realizations on low-energy modes, wherein non-on-site lattice translation symmetry is encoded as if it is a local symmetry, the anomalies of the symmetry in the low-energy theory play different roles in these two systems. In particular, as I will show, the usual chiral anomaly is equivalent to the LSM theorem, whereas there is another anomaly which is not related to the LSM theorem but intrinsic to the SPT states. As an application, the conventional LSM theorem is extended to multiple-charge multiple-species problems, and several exotic symmetric insulators are constructed.

Contact: Markus Müller, WHGA/136, Markus.Mueller@psi.ch, tel: 056 310 44 30