**Alexey SOLUYANOV**
University of Zurich
Institute for Theoretical Physics
Winterthurerstrasse 190
8057 Zurich, Switzerland

# Standard model for crystalline materials: beyond the elementary particles and the 10-fold classification of non-interacting topological phases

Abstract:

One of the research directions in string theory is the separation of important theoretical problems into distinct classes based on their similarities. Electronic structure problem is usually not considered to be important in the string theory community. In this talk I will show that the electronic structure theory in fact allows not only for theoretical analysis of problems in quantum field theory and general relativity, but also for their cheap (on the LHC scale) experimental tests, and also provides many hints to other problems in physics, often considered to be of bigger importance than the study of material properties. In particular, I will show that even weakly-interacting crystalline materials realize a collection of topologically-protected quasiparticle excitations that can either be direct analogs of relativistic elementary particles, or due to the absence of Lorentz-symmetry constraint realize completely novel quasiparticles not present in the high-energy standard model. Materials that host such quasiparticles exhibit special transport properties. I will give a detailed description of several families of such materials. Finally, I will show that even the simplest elemental compounds hide physical phenomena that provide very accessible analogies to complicated theoretical physics theories, and illustrate that the current understanding of even the simplest non-correlated crystalline materials is far from complete.