

# MATHEMATICAL PROBLEMS IN THE THEORY OF TOPOLOGICAL INSULATORS

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The talk is devoted to the theory of topological insulators — a new and actively developing direction in solid state physics. To find a new topological object one have to look for the appropriate topological invariants and systems for which these invariants are non-trivial. The topological insulators are characterized by having wide energy gap stable for small deformations. A nice example is given by the quantum Hall spin insulator. It is a two-dimensional insulator invariant under the time reversal. It is characterized by the non-trivial topological  $\mathbb{Z}_2$ -invariant introduced by Kane and Mele.

In our talk we consider the topological insulators invariant under time reversal. In the first part we present the physical basics of their theory while the second part deals with the mathematical aspects. These aspects are closely related to K-theory and non-commutative geometry.

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