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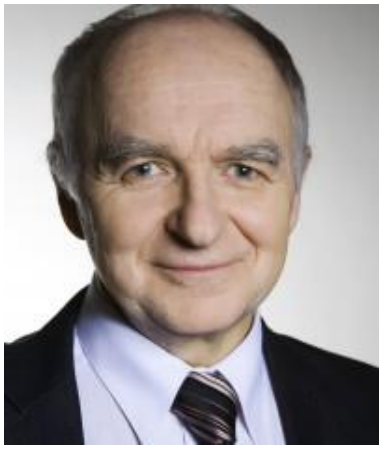
Relativistic hydrodynamics of electrons in solids (with chiral anomaly and Z2 symmetry)



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Streszczenie:

Some solutions of the Dirac equation have been considered in high energy physics to describe the novel elementary particles; however, they were not observed in nature. This seems to be true for both Majorana particle being its own antiparticle and massless Weyl fermion. Due to advances in condensed matter and material physics these particles appear in solids as emergent phenomena. When two non-degenerate bands in three-dimensional topological semimetals cross at the Fermi energy the low energy excitations behave exactly as Weyl fermions. In two-dimensional graphene the crossing of the bands leads to the appearance of the massless Dirac fermions. Both Dirac fermions in graphene and Weyl fermions in Weyl (or Dirac) semimetals exhibit many exotic quantum phenomena and present active field of research in condensed matter physics. The observation of the hydrodynamic flow of electrons in graphene and the observation of the signatures of chiral anomaly in Dirac and Weyl semimetals belong to the most important recent highlights in the field. During the talk I shall discuss the experimental measurements of the shear viscosity of electrons not only in graphene but also in palladium cobaltate (PdCoO2) with simple one band spectrum. I will also discuss the properties of materials with chiral anomaly and additional Z2 symmetry. The Weyl fermion carries a definite chirality. On the classical level chirality is conserved, but this conservation law is broken (chiral anomaly) at the quantum level in the presence of electric and magnetic fields. Relativistic hydrodynamics of fluids with chiral anomaly require several novel transport coefficients like chiral magnetic or chiral vortical conductance and modifies the standard ones. The results we have obtained for strongly interacting electrons within the holographic analogy well describe the magnetoconductivity in type-II Dirac semi-metals, like Cd3As2 and Na3Bi.

Przed referatem (15.45) zapraszamy na kawę. Wszyscy zainteresowani mile widziani ☺