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Relations between Condensed Matter Physics and Relativistic Quantum Field Theory

Guest Editor:

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Message from the Guest Editor

Dear colleagues,

It has been known for a long time that certain features of high energy physics may be simulated in laboratory conditions using various condensed matter systems. In particular, the fermionic quasiparticles in superfluid Helium-3A are described by the (anisotropic) massless Dirac equation. In recent years, new materials have been discovered, where such an analogy is even more pronounced: graphene, Weyl semimetals, and Dirac semimetals. The quasiparticles in these materials also behave similarly to the elementary particles of high energy physics. Unlike the quasiparticles in Helium-3, they carry an ordinary electric charge, which facilitates simulation of electromagnetic phenomena specific to the physics of elementary particles. The mentioned analogy opens up the possibility to apply deep understanding of relativistic quantum field theories to the solution of various problems of condensed matter physics. In particular, the lattice field theory techniques may be applied to the physics of solids. In turn, various approaches of condensed matter physics theory may be applied to the high energy physics.

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Special Issue

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Message from the Editor-in-Chief

Symmetry is ultimately the most important concept in natural sciences. It is not surprising then that very basic and fundamental research achievements are related to symmetry. For instance, the Nobel Prize in Physics 1979 (Glashow, Salam, Weinberg) was received for a unified symmetry description of electromagnetic and weak interactions, while the Nobel Prize in Physics 2008 (Nambu, Kobayashi, Maskawa) was received for the discovery of the mechanism of spontaneous breaking of symmetry, including CP symmetry. Our journal is named *Symmetry* and it manifests its fundamental role in nature.

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