Special Issue

Topological Field Theory and Stochastic Dynamics

Message from the Guest Editor

More than forty years ago, Parisi and Sourlas established that there is a hidden supersymmetry in stochastic differential equations (SDEs) with gradient flows. Further work exposed the topological nature of this supersymmetry and led to the formulation of cohomological field theories (ChTF). More recently, Parisi–Sourlas approach was extended to SDEs of general form. It turned out that topological supersymmetry exists in all SDEs and its spontaneous breakdown is essentially the stochastic generalization of the dynamical systems' nonintegrability, i.e., chaos, that encompasses such physical concepts as 1/f noise, self-organization, and complex dynamics. Due to unmatched applicability of the general form SDEs in science, the so-emerging supersymmetric theory of stochastic dynamics offers unprecedented possibility to apply the machinery of ChFT to neurodynamics, stockmarkets etc. In return, mathematical physics may acquire the widest experimental testbed for fundamental theoretical concepts that were previously available only on paper. This promises a fruitful crossfertilization between ChTF, dynamical systems theory, and other related disciplines.

Guest Editor

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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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