Special Issue

The Quantum Simulation of Everything (and Beyond)

Message from the Guest Editor

The ability of emulating complex behavior seems to have been a key feature in the development of human culture and society. Nowadays, simulations are ubiquituous, from arts to computer sciences. Since quantum theory describes a fundamental section of nature, it is natural to follow Feynman's advice and use quantum technology to simulate quantum systems of interest, overcoming classical frontiers. However, on the one hand, important questions in quantum mechanics and quantum field theory, such as the description of superconductivity at high temperatures, remain open; on the other hand, the precise boundaries of quantum theory, for instance, the emergence of classicality, the compatibility with gravity, or the relevance of holographic dualities, are yet unknown. In this light, quantum simulators can be seen not only as post-classical computers but as tools to explore the frontiers of theoretical physics since they provide an experimentally amenable testbed for fundamental problems. However, what are the exact limitations of this approach? Can a quantum simulator simulate everything.....

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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