Special Issue

Quantum Symmetries: Structures, Dynamics, and Algebra

Message from the Guest Editor

Quantum symmetries play a foundational role in the mathematical structure of various domains within quantum physics, including quantum mechanics, relativistic quantum mechanics, quantum field theory, the Standard Model, Grand Unified Theories (GUTs), and condensed matter physics. Beyond their connection to conservation laws, quantum symmetries provide essential restrictions that help formulate robust and physically consistent theories. Quantum theory and particle physics are fundamentally built on symmetries involving the following:

- Unitary operator groups, which govern the evolution of quantum systems.
- Hermitian operator groups, which describe quantum states and observables.

The $SU(2)$ symmetry is particularly significant in describing quantum spin and the algebra of rotational transformations of quantum states. In non-relativistic quantum mechanics, Lie groups and their associated generators are commonly used to represent continuous symmetries, such as rotations and phase shifts. These groups define how quantum systems transform smoothly under such operations...

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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