Advances in Mathematical Physics

Special Issue on

Lie Group Representation Theory, Coherent States, Wavelets, and Applications to Quantum Physics

Call for Papers

The long sought-for unification of all interactions and exact solvability of quantum (field) theory and statistics parallels the quest for new symmetry principles. Symmetry is an essential resource when facing those two fundamental problems, either as a valuable (mathematical) classification tool, a (gauge) guiding principle, or an essential building block, when the group structure is taken to the ultimate consequences. Although the representation theory of finite-dimensional Lie groups is fairly well understood, the representation theory of infinite-dimensional groups and algebras has not progressed very far, except for some important achievements in one and two dimensions (mainly: Virasoro, W ∞ and Kac-Moody symmetries, in connection with conformal invariant quantum field theories), and necessary breakthroughs in the subject remain to be carried out.

Researchers in the field are invited to contribute original and review articles that put forward new classes of (infinite-dimensional) symmetries, providing a new arena for integrable (field) models in higher dimensions, as well as resurrecting old quiescent symmetries which deserve further attention or new physical interpretation.

For square integrable unitary irreducible representations of a group G, we have the important (mathematical and physical) notion of Coherent States (CSs), a particular case of which are the so-called Wavelets when G is a group of motions on a manifold X containing dilations (namely, conformal transformations). CSs play a central role in quantum optics, Bose-Einstein condensates, superconductivity, quantum Hall effect, and so forth. From a mathematical point of view, they are useful to clarify the classical limit, since the star-commutator of covariant symbols is a Moyal-like (quantum) deformation of the classical Poisson bracket. Moreover, the Wavelet Transform (or CS map) and its discretization have led to multiresolution analysis with multiple applications, in particular, in signal and image analysis. The exploitation of wavelets techniques and their extension to conformal-like symmetry groups in quantum (field) theory are also worth exploring. Potential topics include, but are not limited to:

- Finite- and infinite-dimensional Lie groups and algebras in quantum physics
- Central extensions and projective representations
- Extensions of diffeomorphism groups and quantum gravity
- Quantum integrable systems
- Conformal symmetry in quantum physics
- Group structures in quantum computation and information
- Coherent state methods in geometric quantization and Moyal-like products
- Generalized wavelet transforms based on groups

Before submission authors should carefully read over the journal's Author Guidelines, which are located at http://www.hindawi.com/journals/amp/guidelines/. Prospective authors should submit an electronic copy of their complete manuscript through the journal Manuscript Tracking System at http://mts.hindawi.com/ according to the following timetable:

Manuscript Due	October 1, 2011
First Round of Reviews	January 1, 2012
Publication Date	April 1, 2012

Lead Guest Editor

Manuel Calixto, Department of Applied Mathematics, Faculty of Sciences, University of Granada, 18071 Granada, Spain; calixto@ugr.es

Guest Editors

Sergio Albeverio, Interdisziplinares Zentrum fur Komplexe Systeme, Universitat Bonn, 53117 Bonn, Germany; albeverio@uni-bonn.de

Victor Aldaya, Instituto de Astrofisica de Andalucia, Consejo Superior de Investigaciones Cientificas (CSIC), 18080 Granada, Spain; valdaya@iaa.es

Jean-Pierre Antoine, Institut de Recherche en Mathematique et Physique (IRMP), Universite Catholique de Louvain 2, 1348 Louvain-la-Neuve, Belgium; jean-pierre.antoine@uclouvain.be