Hindawi
Advances in High Energy Physics
Volume 2019, Article ID 2758906, 2 pages
https://doi.org/10.1155/2019/2758906

Editorial

Analytical Methods for High Energy Physics

Saber Zarrinkamar,[1] **Andrzej Okniński**,[2] **and Chun-Sheng Jia**[3]

[1]*Department of Basic Sciences, Garmsar Branch, Islamic Azad University, Garmsar, Iran*
[2]*Chair of Mathematics and Physics, Politechnika Świętokrzyska, Kielce, Poland*
[3]*State Key Laboratory of Oil and Gas Reservoir Geology and Exploitation, Southwest Petroleum University, Chengdu, China*

Correspondence should be addressed to Saber Zarrinkamar; zarrinkamar.s@gmail.com

Received 3 December 2018; Accepted 3 December 2018; Published 5 March 2019

High energy physics is an exciting field of experimental and theoretical research. While the important stimulus comes from the experiment, analytical methods are gaining importance. For example, new analytical approaches, such as Lie groups, path integrals, integrable and superintegrable systems, renormalization methods, factorization methods, Green functions, special functions, homotopy method, integral transforms, and approximate methods based on perturbative or variational treatments to solve differential equations of high energy physics, are becoming more useful. Moreover, there is a significant input of new formulations of quantum mechanics and field theory used in particle physics such as new kinds of interactions, wave equations in curved spaces, fractional order wave equations, noncommutative quantum mechanics, or quantum deformed algebras which may lead to better understanding of high energy physics.

In this special issue we propose a selection of papers, devoted to mathematical problems of high energy and particle physics, where analytical approaches and ideas are used as the main tool to study particle physics.

Several authors studied applications of special functions. The useful review paper by M. Hortaçsu concentrates on properties of the Heun equation and Heun functions which find applications in General Relativity and astrophysics.

There were several papers in which the Schrödindger equation and the Dirac equation were solved in various potentials. For example, S. Dong et al. found exact solutions of the Schrödinger equation in Razavy Cosine Type equation. I. A. Assi et al. obtained solutions for D-dimensional Schrödinger equation in Pöschl-Teller type potential. Y. You et al. solved the Schrödinger equation in Double Ring-Shaped Coulomb Potential and computed several space probability distributions of the solutions.

N. Mohajery et al. solved the six-dimensional hyperradial Schrödinger equation describing baryons consisting of two heavy quarks and one light quark to compute the mass spectra. This result may be particularly useful since masses of majority of such baryons are unknown.

There are also several interesting papers exploring less standard problems. M.-A. Dariescu and C. Dariescu solve the Klein-Gordon and the Dirac equations in the Melvin spacetime in terms of Heun functions. These solutions describe particles moving in the neighbourhood of magnetars. M. Singh studies in two papers the neutrino mass matrix. R. Jora constructs the effective Standard Model potential based on the requirement that the tree level and quantum level trace anomalies must be satisfied. M. Znojil studies in his paper the important problem of quasi-Hermitian formulation of Quantum Mechanics. He demonstrates that for weakly nonlocal interaction potentials non-Hermitian and Hermitian formulations describe the sane dynamics.

We do hope that the readers will find the present special issue interesting and useful.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

Acknowledgments

The guest editors congratulate the authors who contributed to this special issue and express their gratitude to the reviewers who devoted their time to improve the issue.

Saber Zarrinkamar
Andrzej Okniński
Chun-Sheng Jia