# Special Issue

# Fractional Calculus Across Physical Scales: From Classical to Quantum Theories in Low- and High-Dimensional Systems

## Message from the Guest Editors

This Special Issue seeks to explore innovative mathematical techniques in fractional calculus and their cross-disciplinary applications to advance our understanding of physical phenomena. Key themes include, but are not limited to the following:

- Fractional Hamiltonian/Lagrangian formulations;
- Fractional dynamical systems in classical mechanics;
- Anomalous wave propagation in fractional continua and field theories;
- Fractional Schrödinger equations, quantum coherence, and decoherence mechanisms in open quantum systems;
- Fractional Schrödinger and Dirac equations in low-dimensional systems;
- Fractional field theories and their role in modeling non-local interactions in electromagnetism, gravity, and cosmology;
- Fractal spaces and calculus in classical and quantum physics;
- Non-local quantum field theories and renormalization in fractional spacetime dimensions;
- Dimensional regularization techniques using fractional operators;
- Numerical schemes for fractional PDEs in higher-dimensional classical/quantum systems;
- Interplay between fractional operators and symmetry principles in theoretical physics.

## Guest Editors

Prof. Dr. Ion Vancea

Dr. Cresus F.L. Godinho

Dr. Thiago R. Araujo

## Deadline for manuscript submissions

20 November 2025

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## About the Journal

### Message from the Editor-in-Chief

The journal *Mathematics* publishes high-quality, refereed papers that treat both pure and applied mathematics. The journal highlights articles devoted to the mathematical treatment of questions arising in physics, chemistry, biology, statistics, finance, computer science, engineering and sociology, particularly those that stress analytical/algebraic aspects and novel problems and their solutions. One of the missions of the journal is to serve mathematicians and scientists through the prompt publication of significant advances in any branch of science and technology, and to provide a forum for the discussion of new scientific developments.

### Editor-in-Chief

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