

## Special Issue

# From Fundamental Fields to Information and Emergent Phenomena: Theory and Applications of Quantum Electrodynamics

### Message from the Guest Editors

Quantum electrodynamics (QED), the electromagnetic component of the Standard Model, is regarded as the most precisely tested quantum field theory (QFT) to date. Originally formulated to describe fundamental interactions among electrically charged particles and radiation, QED also provides the basis of effective theoretical descriptions in a variety of systems, including quantum and topological materials. Recent developments in information theory, non-equilibrium dynamics, and emergent phenomena in quantum systems have further expanded the conceptual framework and applications of QED-inspired approaches. This Special Issue aims to bring together theoretical and applied contributions that explore electromagnetic quantum systems as carriers of information and platforms for emergent behavior. Topics of interest include, but are not limited to, information-theoretical approaches to QFT, entropy in electromagnetic environments, effective QED descriptions of Dirac and Weyl materials, and broader theoretical perspectives linking QED to effective field theories and the Standard Model.

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### Message from the Editor-in-Chief

The concept of entropy is traditionally a quantity in physics that has to do with temperature. However, it is now clear that entropy is deeply related to information theory and the process of inference. As such, entropic techniques have found broad application in the sciences.

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