Special Issue

Transport and Diffusion in Quantum Complex Systems

Message from the Guest Editors

Our understanding of the transport of energy, mass, charge, or information in complex quantum systems plays a key role from both a fundamental and technological point of view. As such, it is triggering a large amount of theoretical and experimental research that aims to understand and exploit quantum coherent phenomena for the development of quantum devices that may outperform their classical counterparts. Quantum interference is the origin of a number of peculiar effects, such as ballistic transport along lattices and resonant tunneling. On the other hand, the presence of unavoidable interactions with the surrounding environment typically leads to a loss of coherence and to the emergence of a diffusive behavior, closer to the classical scenario, that, in some cases, enhances the transport efficiency. The control of such phenomena, together with our understanding of the transition from microscopic to macroscopic or from single-particle to few- or many-particle systems, is of utmost importance for the successful build-out of quantum technologies, and constitutes the focus of this Special Issue.

Guest Editors

Dr. Paolo Bordone

1. Dipartimento di Scienze Fisiche, Informatiche e Matematiche, Università degli Studi di Modena e Reggio Emilia, via Campi 213/A, 41125 Modena, Italy
2. Centro S3, CNR-Istituto di Nanoscienze, via Campi 213/A, 41125 Modena, Italy

Dr. Dario Tamascelli

Dipartimento di Fisica "Aldo Pontremoli", Università degli Studi di Milano, via Celoria 16, 20133 Milano (MI), Italy

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Entropy
Editorial Office
MDPI, Grosspeteranlage 5
4052 Basel, Switzerland
Tel: +41 61 683 77 34
entropy@mdpi.com

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Editor-in-Chief

Prof. Dr. Kevin H. Knuth
Department of Physics, University at Albany, 1400 Washington Avenue, Albany, NY 12222, USA

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