entropy

an Open Access Journal by MDPI

IMPACT FACTOR
2.738

Indexed in:
PubMed

Section Quantum Information

entropy

IMPACT FACTOR 2.738

Indexed in: PubMed

an Open Access Journal by MDPI

Section Editor-in-Chief

Prof. Dr. Rosario Lo Franco

Università degli Studi di Palermo, Viale delle Scienze, Palermo, Italy

Section Information

In calling for papers we are guided by two remarkable aspects of the field of Quantum Information Science (QIS):

i. QIS has led to the refinement and enlargement of principles of both information theory and quantum mechanics, outside of its own boundaries where the two essentially overlap. It has opened new windows and suggested deeper foundational principles for statistical mechanics. It has given new meaning to the second law of thermodynamics. Intimate connections are being found with gravity and the structure of space–time.

ii. Regarding practical applications, QIS has produced breakthroughs in metrology. Quantum cryptographic devices are now produced and sold commercially, while more advanced schemes continue to be discovered. QIS has spawned new methods in quantum chemistry and in correlated many-body systems. QIS is useful in addressing questions regarding the possible role of quantum coherence in biological systems.

A general goal of this section of the journal is to point out how QIS has impacted the way we think about other subfields. We especially encourage authors to submit papers that do this.

Section Quantum Information

Featured Papers

DOI:10.3390/e25040645

Collapse Models: A Theoretical, Experimental and Philosophical Review

Authors: Angelo Bassi, Mauro Dorato and Hendrik Ulbricht

Abstract: In this paper, we review and connect the three essential conditions needed by the collapse model to achieve a complete and exact formulation, namely the theoretical, the experimental, and the ontological ones. These features correspond to the three parts of the paper. In any empirical science, the first two features are obviously connected but, as is well known, among the different formulations and interpretations of non-relativistic quantum mechanics, only collapse models, as the paper well illustrates with a richness of details, have experimental consequences. Finally, we show that a clarification of the ontological intimations of collapse models is needed for at least three reasons: (1) to respond to the indispensable task of answering the question 'what are collapse models (and in general any physical theory) about?'; (2) to achieve a deeper understanding of their different formulations; (3) to enlarge the panorama of possible readings of a theory, which historically has often played a fundamental heuristic role.

DOI:10.3390/e25040580

A Variational Quantum Linear Solver Application to Discrete Finite-Element Methods

Authors: Corey Jason Trahan, Mark Loveland, Noah Davis and Elizabeth Ellison

Abstract: Finite-element methods are industry standards for finding numerical solutions to partial differential equations. However, the application scale remains pivotal to the practical use of these methods, even for modern-day supercomputers. Large, multi-scale applications, for example, can be limited by their requirement of prohibitively large linear system solutions. It is therefore worthwhile to investigate whether near-term quantum algorithms have the potential for offering any kind of advantage over classical linear solvers. In this study, we investigate the recently proposed variational quantum linear solver (VQLS) for discrete solutions to partial differential equations. This method was found to scale polylogarithmically with the linear system size, and the method can be implemented using shallow quantum circuits on noisy intermediate-scale quantum (NISQ) computers. Herein, we utilize the hybrid VQLS to solve both the steady Poisson equation and the time-dependent heat and wave equations.

DOI:10.3390/e25030538

Quantization of Integrable and Chaotic Three-Particle Fermi–Pasta–Ulam–Tsingou Models

Authors: Alio Issoufou Arzika, Andrea Solfanelli, Harald Schmid and Stefano Ruffo

Abstract: We study the transition from integrability to chaos for the three-particle Fermi–Pasta–Ulam–Tsingou (FPUT) model. We can show that both the quartic β-FPUT model (α=0) and the cubic one (β=0) are integrable by introducing an appropriate Fourier representation to express the nonlinear terms of the Hamiltonian. For generic values of α and β, the model is non-integrable and displays a mixed phase space with both chaotic and regular trajectories. In the classical case, chaos is diagnosed by the investigation of Poincaré sections. In the quantum case, the level spacing statistics in the energy basis belongs to the Gaussian orthogonal ensemble in the chaotic regime, and crosses over to Poissonian behavior in the quasi-integrable low-energy limit. In the chaotic part of the spectrum, two generic observables obey the eigenstate thermalization hypothesis.

DOI:10.3390/e25030500

Optomechanics-Based Quantum Estimation Theory for Collapse Models

Authors: Marta Maria Marchese, Alessio Belenchia and Mauro Paternostro

Abstract: We make use of the powerful formalism of quantum parameter estimation to assess the characteristic rates of a continuous spontaneous localization (CSL) model affecting the motion of a massive mechanical system. We show that a study performed in non-equilibrium conditions unveils the advantages provided by the use of genuinely quantum resources—such as quantum correlations—in estimating the CSL-induced diffusion rate. In stationary conditions, instead, the gap between quantum performance and a classical scheme disappears. Our investigation contributes to the ongoing effort aimed at identifying suitable conditions for the experimental assessment of collapse models.

Selected Topic Collection

Quantum Information
Collection Editor: Jay Lawrence

Invitation to read

Quantum Information and Quantum Optics
Guest Editors: Antonino Messina and Agostino Migliore

Quantum Communication, Quantum Radar, and Quantum Cipher
Guest Editor: Osamu Hirota

Quantum Information and Computation
Guest Editors: Shao-Ming Fei, Ming Li and Shunlong Luo

Completeness of Quantum Theory: Still an Open Question
Guest Editor: Marian Kupczynski

MDPI is a member of

Affiliated Societies

Follow

facebook.com/MDPIOpenAccessPublishing

twitter.com/MDPIOpenAccess

linkedin.com/company/mdpi

instagram.com/mdpiopenaccess

weibo.com/mdpicn

Wechat: MDPI-China

Subscribe

blog.mdpi.com

mdpi.com **mdpi.com/journal/entropy**

Visit mdpi.com for a full list of offices and contact information.
MDPI is a company registered in Basel, Switzerland, No. CH-270.3.014.334-3,
whose registered office is at St. Alban-Anlage 66, CH-4052 Basel, Switzerland.