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Quantum Information and Foundations

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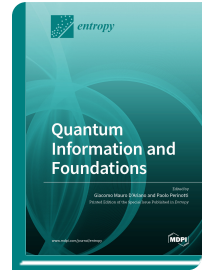
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Quantum information has dramatically changed information science and technology, looking at the quantum nature of the information carrier as a resource for building new information protocols, designing radically new communication and computation algorithms, and ultra-sensitive measurements in metrology, with a wealth of applications. From a fundamental perspective, this new discipline has led us to regard quantum theory itself as a special theory of information, and has opened routes for exploring solutions to the tension with general relativity, based, for example, on the holographic principle, on non-causal variations of the theory, or else on the powerful algorithm of the quantum cellular automaton, which has revealed new routes for exploring quantum fields theory, both as a new microscopic mechanism on the fundamental side, and as a tool for efficient physical quantum simulations for practical purposes. In this golden age of foundations, an astonishing number of new ideas, frameworks, and results, spawned by the quantum information theory experience, have revolutionized the way we think about the subject, with a new research community emerging worldwide, including scientists from computer science and mathematics.



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