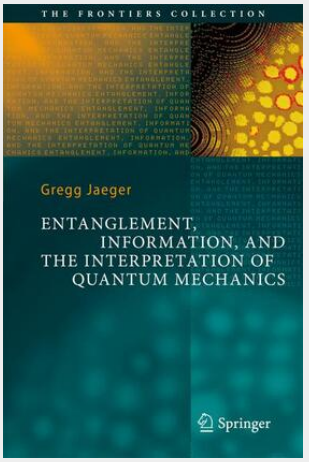
Jaeger

Entanglement, Information, and the Interpretation of Quantum Mechanics



Entanglement was initially thought by some to be an oddity restricted to the realm of thought experiments. However, Bell's inequality delimiting local - havior and the experimental demonstration of its violation more than 25 years ago made it entirely clear that non-local properties of pure quantum states are more than an intellectual curiosity. Entanglement and non-locality are now understood to ?gure prominently in the microphysical world, a realm into which technology is rapidly hurtling. Information theory is also increasingly recognized by physicists and philosophers as intimately related to the foun- tions of mechanics. The clearest indicator of this relationship is that between quantum information and entanglement. To some degree, a deep relationship between information and mechanics in the quantum context was already there to be seen upon the introduction by Max Born and Wolfgang Pauli of the idea that the essence of pure quantum states lies in their provision of probabilities regarding the behavior of quantum systems, via what has come to be known as the Born rule. The signi?cance of the relationship between mechanics and information became even clearer with Leo Szilard's analysis of James Clerk Maxwell's infamous demon thought experiment. Here, in addition to examining both entanglement and quantum infor- tion and their relationship, I endeavor to critically assess the in?uence of the study of these subjects on the interpretation of quantum theory.

This book explores the nature of quantum entanglement and quantum information and their role in the quantum world. Their relations to a number of key experiments and thought experiments in the history of quantum physics are considered, as is a range of interpretations of quantum mechanics that have been put forward as a means of understanding the fundamental nature of microphysics - the traditionally accepted domain of quantum mechanics - and in some cases, the universe as a whole. In this way, the book reveals the deep significance of entanglement and quantum information for our understanding of the physical world. This book is a major accomplishment and invaluable contribution -- Arkady Plotnitsky An encyclopedic treatment of conceptual quantum mechanics as seen from a very up-to-date point of view --Tom Toffoli A mine of ideas for physicists, philosophers, and all intellectuals interested in this scientific revolution -- Giacomo Mauro D'Ariano

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