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| | Nota di contenuto | Introduction -- Classical Dynamics on R^d -- Stochastic Dynamics on R^d -- Complex Stochastic Dynamics on R^d -- Relativistic Stochastic Dynamics on R^d,1 -- Stochastic Dynamics on pseudo-Riemannian Manifolds -- Stochastic Interpretation -- Discussion. |
| | Sommario/riassunto | Stochastic mechanics is a theory that holds great promise in resolving the mathematical and interpretational issues encountered in the canonical and path integral formulations of quantum theories. It provides an equivalent formulation of quantum theories, but substantiates it with a mathematically rigorous stochastic interpretation by means of a stochastic quantization prescription. The book builds on recent developments in this theory, and shows that quantum mechanics can be unified with the theory of Brownian motion in a single mathematical framework. Moreover, it discusses the extension of the theory to curved spacetime using second order geometry, and the induced Itô deformations of the spacetime symmetries. The book is self-contained and provides an extensive review of stochastic |

mechanics of the single spinless particle. The book builds up the theory on a step by step basis. It starts, in chapter 2, with a review of the classical particle subjected to scalar and vector potentials. In chapter 3, the theory is extended to the study of a Brownian motion in any potential, by the introduction of a Gaussian noise. In chapter 4, the Gaussian noise is complexified. The result is a complex diffusion theory that contains both Brownian motion and quantum mechanics as a special limit. In chapters 5, the theory is extended to relativistic diffusion theories. In chapter 6, the theory is further generalized to the context of pseudo-Riemannian geometry. Finally, in chapter 7, some interpretational aspects of the stochastic theory are discussed in more detail. The appendices concisely review relevant notions from probability theory, stochastic processes, stochastic calculus, stochastic differential geometry and stochastic variational calculus. The book is aimed at graduate students and researchers in theoretical physics and applied mathematics with an interest in the foundations of quantum theory and Brownian motion. The book can be used as reference material for courses on and further research in stochastic mechanics, stochastic quantization, diffusion theories on curved spacetimes and quantum gravity.