

Statistical Mechanics

A Concise Advanced Textbook

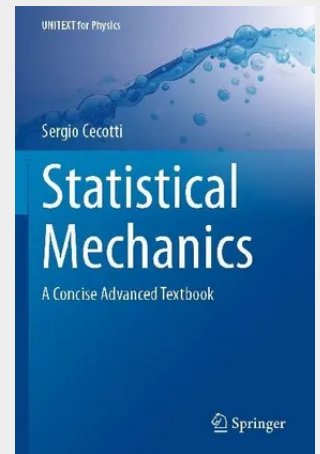
This textbook is based on lecture notes that the author delivered at Qiuzhen College (Tsinghua University), a Chinese institution known for its exceptionally talented mathematics students. The book's intended audience shapes its character. It introduces Statistical Mechanics from the ground up, offering a fully self-contained presentation that aims for mathematical precision. It distinguishes rigorous results from controlled approximations and provides physical insights into phenomena.

Despite its concise nature (suited for a one-semester basic course), this book covers several topics typically not found in introductory texts. These include Shannon's information-theoretic interpretation of entropy, the gauge approach to order-disorder duality in the Ising model, the Yang-Lee theory, and the quantum dissipation-fluctuation theorem. Additionally, it explores frustrated and quenched systems, including an introduction to the celebrated Parisi solution of the Sherrington-Kirkpatrick model of spin glasses.

The path integral formalism is extensively discussed from various perspectives to suit different applications. Chapter 2 approaches path integrals through the Feynman-Kac formula and second quantization. In Chapter 5, they are examined within the context of effective field theories like Landau-Ginzburg theory, while Chapter 6 delves into their connection with Brownian motion, Langevin stochastic differential equations, and Fokker-Planck diffusion PDEs. The book also explores the relationship between stochastic processes and supersymmetry.

Various techniques for computing path integrals, especially functional determinants, are introduced throughout the relevant chapters, offering the most suitable computational tools for each application.

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