

1. Record Nr.	UNISA996499864403316
Autore	Miyashita Seiji
Titolo	Collapse of metastability : dynamics of first-order phase transition // Seiji Miyashita
Pubbl/distr/stampa	Singapore : , : Springer, , [2022] ©2022
ISBN	9789811966682 9789811966675
Descrizione fisica	1 online resource (260 pages)
Collana	Fundamental Theories of Physics ; ; v.211
Disciplina	016.61483
Soggetti	Quantum theory Many-body problem
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Intro -- Preface -- Contents -- 1 Introduction -- 1.1 Concept of Metastability -- 1.1.1 Life Time of a Metastable State -- Part I Metastability in Classical Systems -- 2 Metastability in Thermodynamic Systems -- 2.1 Introduction -- 2.2 Mean-Field Theory for a Ferromagnetic Ising System -- 2.2.1 Self-consistent Equation of the Magnetization -- 2.2.2 Magnetization Curve -- 2.2.3 Free Energy as a Function of Magnetization -- 2.3 Rotation of Magnetization -- 2.3.1 Stoner-Wohlfarth Model -- 2.3.2 Stoner-Wohlfarth Diagram -- 2.3.3 Trajectory -- 2.4 First-Order Phase Transitions as a Function of the Temperature -- 2.4.1 A Model with Many Degeneracy of Zero Energy States -- 2.4.2 Blume-Capel Model -- 2.4.3 Spin Crossover Systems -- 2.5 Landau Theory -- 2.5.1 Landau Theory for Temperature Induced First-Order Phase Transition -- 2.6 Gas-Liquid Phase Transition -- 2.6.1 Phenomenological Method: van der Waals (vDW) Equation -- 2.7 Statistical Treatments of the Gas-Liquid Phase Transition -- 2.7.1 Perturbational Approach -- 2.7.2 Lattice-Gas Model Approach -- 2.7.3 Mean-Field Analysis for the Lattice Gas Model -- 3 Escape Rate from the Metastable State -- 3.1 Introduction -- 3.2 Arrhenius Law -- 3.3 Kramers Method -- 3.4 Spinodal Singularity -- 3.4.1 Master Equation for the Husimi-Temperley Model -- 3.5 Nucleation in Model Short-Range Interaction -- 3.6 Dynamical Spinodal Point -- 3.7 Survival

Probability of a Metastable State -- 3.7.1 Néel-Arrhenius Process -- 4  
Spatial Pattern During the Transition -- 4.1 Dynamics Associated with  
the First-Order Phase Transition -- 4.2 Dynamics After the  
Temperature Quenching -- 4.2.1 Non-conserved System:  $k^2 t$  Scaling --  
4.2.2 A Stretched Exponential Law for Spin-  
Autocorrelation Function -- 4.2.3 Conserved System: Lifshitz-Slyozov-  
Wigner Theory  $k^3 t$  Scaling -- 4.2.4 Ostwald Ripening.  
Part II First-Order Phase Transition from Viewpoints of the Eigenvalue  
Problem -- 5 Structure of Eigenvalues for the First-Order Phase  
Transition -- 5.1 Transfer Matrix -- 5.1.1 Ladder Systems -- 5.1.2 Free  
Energy -- 5.1.3 Correlation Functions -- 5.1.4 Temperature  
Dependence of the Eigenvalues -- 5.1.5 Field Dependence of the  
Eigenvalues Below the Critical Temperature -- 5.2 Eigenvalue Analysis  
of Dynamical Processes -- 5.2.1 Eigenstates of Master Equation --  
5.2.2 Approach to the Stationary State -- 5.3 Kinetic Ising Model --  
5.3.1 Demonstration in a Small System of 2 times 22times2 System --  
5.3.2 Master Equation for the Magnetization for a Model with Long-  
Range Interaction -- 5.3.3 Relaxation times of 4 times 34times3  
System -- 5.4 Eigenvalue Problem of Quantum Master Equation -- 5.5  
Free Energy at the First-Order Phase Transition -- 5.6 Langer's  
Argument -- 5.6.1 Langer's Analysis I: A Picture of Nucleation Cluster  
-- 5.6.2 Langer's Analysis II: Functional Integral -- 5.6.3 Langer's  
Analysis III: A Picture of the Action -- 5.6.4 Langer's Estimation of  
Decay Rate of Metastable State -- Part III Metastability in Quantum  
Systems -- 6 Collapse of Metastability by the Quantum Fluctuation --  
6.1 Introduction -- 6.2 Quantum Mechanical States in Double-Well  
Type Potential -- 6.2.1 Characteristics of Metastability in the Eigenstate  
Spectrum StartSet upper E Subscript i Baseline left parenthesis  $h$  right  
parenthesis EndSet{ $E_i(h)$ } as a Function of Field -- 6.3 Characteristic of  
Eigenvalue Structure Around the First-Order Phase Transition -- 6.4  
Particle Conveyance by a Potential-Well -- 6.4.1 Sudden Start by  
Changing the Velocity from Zero to  $c$  -- 6.4.2 Smooth Acceleration --  
6.4.3 Scattering Problem -- 6.4.4 Relaxation from Metastable Potential  
-- 6.4.5 Carry Up the Particle -- 6.5 Quantum Tunneling in Magnetic  
Systems.  
6.5.1 Metastability in Magnetic Systems -- 6.6 Relaxation of Magnetism  
in Small Systems -- 6.7 Single Molecular Magnets (SMM) -- 6.7.1  
Tunneling Under Dissipation -- 6.7.2 Dynamics in Dissipative  
Environments -- 6.8 Magnetic Foehn Effect -- 6.9 Effect of Dissipation  
on the Relaxation of Metastable State -- 6.9.1 Free-Boson Bath Model  
-- 6.9.2 Dynamics of the Magnetization in Uniaxial Anisotropy -- 6.9.3  
Effects of Dissipation on the Hybridized Lowest Two States -- 6.10  
Quantum Stoner-Wohlfarth Model -- 6.10.1 Dynamics of Magnetization  
-- 6.10.2 Distribution of the Population over the States -- 6.10.3  
Dynamics of Magnetization in Dissipative Environment -- 6.11  
Nucleation in Quantum Systems -- 6.12 Transverse-Ising Model --  
6.12.1 Visualization of Quantum and Classical Fluctuation in a left  
parenthesis  $d + 1$  right parenthesis( $d+1$ ) Dimensional  
Representation of States -- 6.13 Cooperative Phenomena in a Cavity  
System -- 6.13.1 Cavity System -- 6.13.2 Phase Transitions of the  
Dicke Hamiltonian -- 6.14 Optical Bistability -- 6.14.1 Mean-Field  
Analysis -- 6.14.2 Analogy to a Picture of Thermodynamic Free Energy  
-- 6.14.3 Numerical Study of the Size Dependence -- 6.14.4  
Metastability in the Bistable Region -- 6.14.5 Hysteresis Phenomena --  
6.15 Limit Cycle of the Hysteresis -- 6.15.1 Dynamics Under an Driving  
Force with Periodically Oscillating Amplitude -- 6.15.2 Floquet Map --  
6.15.3 Mean-Field Analysis of Limit Cycle -- Part IV Quantitative  
Estimation of Relaxation Time -- 7 Coercivity of Magnets -- 7.1

Introduction -- 7.2 Coercivity Estimated by the Free Energy Landscape  
-- 7.2.1 Minimum Energy Path (MEP) Method -- 7.2.2 Free Energy  
Landscape Method -- 7.3 Characteristic Quantities of Magnetization  
Reversal -- 7.3.1 Activation Volume -- 7.3.2 Magnetic Viscosity.  
7.3.3 Relation Between the Activation Volume upper V Subscript normal  
aVa and the Magnetic Viscosity upper SS -- 7.3.4 Coercivity Obtained  
by a Direct Simulation of SLLG -- 7.3.5 Coercivity of Large Grains --  
7.4 Coercivity of Magnets as an Ensemble of Grains -- Part V  
Appendices -- 8 Appendices -- 8.1 Brief Review on the Mean-Field  
Approximation -- 8.1.1 Basic Idea of Mean-Field Theory -- 8.1.2  
Mean-Field Free Energy as a Function of the Magnetization  $F(m;T,H)$  --  
8.1.3 Free Energy in Bragg-Williams Approximation -- 8.1.4 Free  
Energy of the Long-Range Interaction Model (Husimi-Temperley Model)  
-- 8.1.5 Free Energy as a Variational Function -- 8.2 Equation of  
Stochastic Processes -- 8.2.1 Master Equation and Fokker-Planck  
Equation -- 8.2.2 Master Equation in Differential Form -- 8.2.3  
Symmetrization of the Time-Evolution Operator -- 8.2.4 Master  
Equation for Continuous Variable -- 8.2.5 Brownian Motion -- 8.3  
Landau-Zener Scattering -- 8.4 Quantum Master Equation -- 8.4.1  
Lindblad Type -- 8.4.2 Redfield Type -- 8.4.3 Redfield Type for a  
Single Spin -- 8.4.4 Bloch Equation -- 8.4.5 Under a Time-Dependent  
Field -- 8.5 Path-Integral Method -- 8.5.1 One Particle Problem --  
8.5.2 Partition Function at a Finite Temperature -- 8.5.3 Onsager-  
Machlup Formula for Stochastic Process -- 8.6 WKB Approximation --  
8.6.1 Semiclassical Approximation -- 8.6.2 Connection Formula --  
8.6.3 Bound State -- 8.6.4 Transmission Coefficient by WKB  
Approximation -- 8.6.5 Transition Matrix -- 8.6.6 Relaxation from  
Metastable Potential -- Appendix References -- -- Index.

---