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| 1. Record Nr.           | UNINA9910816076903321  |
| Autore                  | Rastelli Enrico  |
| Titolo                  | Statistical mechanics of magnetic excitations : from spin waves to stripes and checkerboards // Enrico Rastelli, Institute of Materials for Electronics and Magnetism, CNR and Department of Physics, University of Parma, Italy   |
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| Descrizione fisica      | 1 online resource (xi, 346 pages) : illustrations  |
| Collana                 | Series on advances in statistical mechanics ; ; vol. 18  |
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| Soggetti                | Spin excitations<br>Nuclear spin<br>Magnetic resonance<br>Statistical mechanics<br>Spin waves  |
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| Livello bibliografico   | Monografia   |
| Note generali           | Description based upon print version of record.  |
| Nota di bibliografia    | Includes bibliographical references and index.   |
| Nota di contenuto       | Preface; CONTENTS; 1. Magnetic Hamiltonians; 1.1. Hydrogen Molecule Hamiltonian; 1.2. Heisenberg Hamiltonian; 1.3. Spin Wave Excitations; 1.4. Two-Spin Deviation Excitations; 1.5. Two-Spin Deviation States in a Ring; 1.6. Spin Waves in Classical Mechanics; 1.7. Heisenberg Hamiltonian for Actual Compounds; 2. Spin Waves in Ferromagnets; 2.1. Spin-Boson Transformation; 2.2. Bosonic Approach to the Heisenberg Hamiltonian; 2.3. Harmonic Approximation; 2.4. Low Temperature Thermodynamic Functions; 2.5. Application to Quasi-2D and Quasi 1D-models; 3. Interacting Spin Waves in Ferromagnets 3.1. Neutron Scattering Cross-Section 3.2. Boson Green Function; 3.3. First-Order Approximation; 3.4. Second-Order Approximation; 3.5. Dyson's Equation; 3.6. Renormalization and Damping; 4. Feynman Diagrams Expansion in Ferromagnets; 4.1. Temperature Green Function and Perturbation Expansion; 4.2. First-Order Perturbation Theory; 4.3. |

Second-Order Perturbation Theory; 4.4. Third-order Perturbation Theory; 4.5. T-matrix Approximation; 5. Two-Magnon Bound States in Ferromagnets; 5.1. Two-Spin Deviation Eigenstates; 5.2. Bound States in 1D; 5.3. Bound States in 2D; 5.4. Bound States in 3D 5.5. Bound States in Anisotropic Ferromagnets 6. Perturbation Theory in Planar Ferromagnets; 6.1. Bogoliubov Transformation; 6.2. The Dyson Matrix Equation; 6.3. First-order Perturbation Theory; 6.4. Second-Order Perturbation Theory; 7. Spin Waves in Non-Collinear Systems; 7.1. Local Axis Transformation and Boson Hamiltonian; 7.2. Harmonic Approximation and Bogoliubov Transformation; 7.3. Ground-State Configurations; 7.4. Neel Antiferromagnet; 7.5. Antiferromagnetism in Close-Packed Lattices; 7.6. Order by Quantum and Thermal Disorder; 7.7. Frustration by Competing Interactions: Square Lattice 7.8. Frustration by Competing Interactions: Triangular Lattice 7.9. Frustration by Competing Interaction: Honeycomb Lattice 7.10. Neutron Scattering Cross-Section for a Helimagnet; 8. Spin Waves in Multilayers; 8.1. Spin Green Functions and Random Phase Approximation; 8.2. Multilayers; 8.3. Bilayer; 8.4. Trilayer; 8.5. Classical Spin Waves in Multilayers; 8.6. Classical Spin Waves in a Semi-Infinite Medium; 9. Spin Waves in Systems with Long Range Interaction; 9.1. Dipole-Dipole Interaction; 9.2. Dipolar Sums and Ewald's Method; 9.3. Ground-State Configuration of  $\text{ErBa}_2\text{Cu}_3\text{O}_{6+x}$  9.4. CEF Calculation for  $\text{ErBa}_2\text{Cu}_3\text{O}_{6+x}$  9.5. Spin Waves in  $\text{ErBa}_2\text{Cu}_3\text{O}_7$ ; 10. Long Range Interactions in 2D Systems; 10.1. Dipole-Dipole Interaction in 2D Systems; 10.2. Planar Rotator Model with Long Range Interactions; 10.3. Stripes and Checkerboards in 2D Ising Model; 10.4. Monte Carlo Simulation; References; Index

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## Sommario/riassunto

The aim of this advanced textbook is to provide the reader with a comprehensive explanation of the ground state configurations, the spin wave excitations and the equilibrium properties of spin lattices described by the Ising-Heisenberg Hamiltonians in the presence of short (exchange) and long range (dipole) interactions. The arguments are presented in such detail so as to enable advanced undergraduate and graduate students to cross the threshold of active research in magnetism by using both analytic calculations and Monte Carlo simulations. Recent results about unorthodox spin configurations suc

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