

NPTEL Video Lecture Topic List - Created by LinuXpert Systems, Chennai

NPTEL Video Course - Physics - NOC:Concepts in Magnetism and Superconductivity

Subject Co-ordinator - Prof. A Taraphder

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

- Lecture 1 - Introduction: Magnetism and superconductivity as macroscopic quantum phenomena
- Lecture 2 - Bohr magneton, BvL theorem
- Lecture 3 - An electron in a magnetic field, magnetism of isolated atoms
- Lecture 4 - Magnetism of isolated atoms (Continued...), Diamagnetism
- Lecture 5 - Magnetism of atoms-dia and paramagnetic susceptibilities. Hund's rules, Van Vleck paramagnetism
- Lecture 6 - Van Vleck paramagnetism (Continued...), Paramagnetism
- Lecture 7 - Curie's law for arbitrary J, adiabatic demagnetization
- Lecture 8 - Paramagnetism of conduction electrons - Pauli paramagnetism
- Lecture 9 - Ions in a solid: crystal field, orbital quenching, Jahn-Teller effect
- Lecture 10 - Jahn-Teller effect (Continued...), Magnetic resonance techniques NMR, ESR
- Lecture 11 - Resonance techniques (Continued...), Recapitulation and overview
- Lecture 12 - Recapitulation, interacting moments and long range order, dipolar exchange
- Lecture 13 - Interacting moments, 2-electron system, origin of exchange and spin Hamiltonian
- Lecture 14 - Spin Hamiltonian, Heisenberg model, Exchange interactions: direct
- Lecture 15 - GMR, spin model and mean-field theory, Ising model
- Lecture 16 - Ising model and its properties
- Lecture 17 - Ising model and its properties (Continued...), absence of LRO in d=1, mean-field theory
- Lecture 18 - Ising model recap, applications, exact solutions
- Lecture 19 - Exact solution of Ising model in d=1, exact results in d=2. Mermin-Wagner theorem
- Lecture 20 - Recap - Exact solution of Ising model. Mermin-Wagner theorem on the absence
- Lecture 21 - Ferromagnetic Heisenberg model ground state
- Lecture 22 - Ferromagnetic Heisenberg model, spin-waves and magnons
- Lecture 23 - Antiferromagnetic Heisenberg model, AF magnetic structures
- Lecture 24 - AF magnetic structures, susceptibility and excitations
- Lecture 25 - Antiferromagnets and frustration, spin glass
- Lecture 26 - Superconductivity: discovery, properties
- Lecture 27 - Superconductivity: Meissner effect, London Equation
- Lecture 28 - Electron-phonon interaction, Cooper problem
- Lecture 29 - Cooper problem, setting up the BCS theory

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- Lecture 30 - BCS wave function, the Superconducting state and calculations of various properties
- Lecture 31 - BCS theory (Continued...), energy gap, transition temperature
- Lecture 32 - Consequences of BCS theory, gap vs T, Transition temperature, specific heat, tunnelling
- Lecture 33 - Transition temperature, specific heat, tunnelling
- Lecture 34 - Andreev reflection, Ginzburg-Landau Theory and electrodynamics of superconductors
- Lecture 35 - Ginzburg-Landau theory, coherence length and Type I and II superconductors
- Lecture 36 - Flux lattice, Flux quantization, Josephson junctions
- Lecture 37 - Josephson effect and Josephson junctions
- Lecture 38 - SQUID, Quantum computers and Josephson junction Qubits
- Lecture 39 - High-Temperature Superconductivity: an enduring enigma
- Lecture 40 - Overview and conclusion