

# Theoretical Statistical Physics

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## Concepts of Thermodynamics

- Kinetic theory of the ideal gas
- Equation of state of the ideal gas
- Reversible and irreversible processes
- Laws of Thermodynamics
- Exact differentials, Legendre transformations
- Thermodynamic potentials

## Classical Statistical Mechanics

- The Maxwell-Boltzmann distribution
- Concepts of statistics (distributions, averages, moments, correlation)
- Brownian motion
- Microstates
- Statistical definition of entropy
- Gibbs' paradox
- Ensemble theory
- The microcanonical ensemble
- Paramagnetism
- Liouville equation
- The canonical ensemble
- Virial theorem and equipartition theorem
- The macrocanonical ensemble
- Harmonic oscillator and Einstein solid
- Diatomic gas
- Relativistic ideal gas

## Quantum statistics

- Density operators
- Many-particle wave functions
- Ideal Bose gas
- Ideal Fermi gas
- Ising model and phase transitions