THERMODYNAMICS AND STATISTICAL MECHANICS

Physics III Lecture Course, first semester 2006

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Contents

Correct Boltzmann counting; Fluctuations; Lecture 10 : Classical Ideal Gases

Microcanon;ical ensemble for an ideal gas; Canonical ensemble for an ideal gas; Grand canonical ensemble for an ideal gas Exercise Set 10.

Lecture 11 : Ideal Bose and Fermi Gases

Classical particles, fermions and bosons; Grand partition functions; The pressure and energy density of a quantum gas; The adiabatic equation of state; Exercise Set 11

Lecture 12 : Degenerate Ideal Fermi Gases

The completely degenerate limit; The almost degenerate limit; The Richardson effect; White dwarf stars; Exercise Set 12

Lecture 13 : Degenerate Bose gases

The degeneracy temperature; Properties of a degenerate Bose gas; Approach to degeneracy; Exercise Set 13

Lecture 14 : Black Body Radiation

The Planck distribution; The black-body spectrum; Very high temperatures; Exercise Set 14

Lecture 15 : The Debye Theory for Solids

Phonons; The Debye interpolation formula; Expansion of solids; Exercise Set 15

Lecture 16 : Ionization Equilibrium

Ionization states of an atom or molecule; Saha's equation Exercise Set 16

Lecture 17 : Order-Disorder Transitions

The Ising model; The Bragg-Williams approximation; A model for ferromagnetism; The specific heat; Exercise Set 17

Lecture 18 : Superfluidity

Phonons and rotons; Viscous effects; Superfluids; Condition for existence of superfluidity Exercise Set 18

Lecture 19 : Thermodynamics in Astrophysics and Cosmology

Big Bang cosmology; The cosmological redshift; The Cosmic Microwave Background; Fluctuations in the CMB; Black holes; Thermodynamics of black holes.