

# Thermal Physics II

## Outline of the Course

## **A Revising / Extending Classical Thermodynamics**

### **A.1 Concepts and Definitions**

### **A.2 Laws of Thermodynamics**

## **1 Closed or Isolated Systems**

### **1.1 Basic Definitions**

### **1.2 Thermodynamics of Closed Systems**

### **1.3 Fundamental Assumptions and Definitions of Statistical Mechanics**

### **1.4 Fluctuations in Large Systems**

### **1.5 The Microcanonical Ensemble**

### **1.6 Example: Einstein solid**

## **2 System with Heat contact to the Environment**

### **2.1 Definition of the Canonical Ensemble**

### **2.2 Thermodynamics for Systems with Fluctuating Energy**

### **2.3 The Canonical Ensemble**

### **2.4 Example: Paramagnet & Einstein Solid**

### **2.5 Energy Fluctuations in the Canonical Ensemble**

### **2.6 Degenerate Energy States**

### **2.7 Canonical Partition Function for Ideal Gases**

### **2.8 Mixing Entropy and Gibbs Paradox**

### **2.9 Example: Gas of Diatomic Molecules**

## **3 Quantum Statistics**

### **3.1 General Remarks on the Insufficiency of Classical Statistics**

### **3.2 Thermodynamics of Open Systems**

### **3.3 The Grand-Canonical Ensemble**

### **3.4 Energy Distribution Functions for Fermions and Bosons**

### **3.5 The Classical Limit**

### **3.6 Ideal Quantum Gases near $T=0$**