

<<热物理学>>

图书基本信息

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前言

Several aims guided me while I wrote. My first goal was to build from the familiar to the abstract and still get to entropy, conceived microscopically, in the second chapter. I sought to keep the book crisp and lean: derivations were to be succinct and simple; topics were to be those essential for physics and astronomy. From the professors perspective, a semester is a short time, and few undergraduate curricula can devote more than a semester to thermal physics. Modularity was another aim. Instructors tastes vary greatly, and so I sought maximal flexibility in what to teach and when to cover it. The books logical structure is displayed in figure PI. Chapters 1 to 3 develop topics that appear in the typical fat textbook for introductory physics but are rarely assimilated by students in that course, if the instructor even gets to the topics. Thus the book presumes only an elementary knowledge of classical mechanics and some rudimentary ideas from quantum theory, primarily the de Broglie relationship $p = h/\lambda$ and the idea of energy eigenstates. A benefit of modularity is that one can study chapter 13 (the classical theory) any time after chapter 5. I placed the classical theory so far back in the book because I think students should get to use the quantum machinery of chapters 4 and 5 on some important physics before they face the development of more formalism. But students need not go through chapters 10, 11, and 12 before they do the classical theory. Chapter 13 is relatively easy, and so it is a good break after an intense chapter (such as chapter 6 or 9). In my own teaching, I tuck in chapter 13 after chapter 9. The books conceptual core consists of four linked elements: entropy and the Second Law of Thermodynamics, the canonical probability distribution, the partition function, and the chemical potential. You may welcome the conceptual economy. All too easily, thermal physics seems to require a radically new tool for every new topic. My aim is to use the four elements again and again, so that my students become comfortable with them and even moderately proficient. A note about teaching strategy may be welcome. My students come to thermal physics without knowing that the density in an isothermal atmosphere drops off exponentially. Therefore, I assign problem 7.1 (the first problem in chapter 7) early enough so that my students have done the problem before I start to talk about chapter 7 in class. Thus the students know what should emerge from the statistical calculation in section 7.1, the calculation that "discovers" the chemical potential.

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内容概要

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章节摘录

When a physical system has reached thermal equilibrium, its macroscopic properties do not change with time. In quantum theory, the energy eigenstates of an isolated system provide predictions and estimates that are constant in time; therefore such states are appropriate for a quantum description of thermal equilibrium. To be sure, the information at hand will not enable us to select a single state as uniquely the correct state to use. We will be driven to consider many states and to form sums over them. This section develops a mathematical technique for working with such sums. When the system is both isolated and of finite size (as we shall specify here), the energy eigenstates form a discrete set, whose members we can arrange and label in order of increasing energy. (If any two distinct states happen to have the same energy) we just assign them consecutive labels.) Typically, the states will be densely spaced in energy, and so a sum over a range of states can often be approximated adequately by an integral with respect to energy, provided that we have constructed an appropriate density of states: a function that specifies the number of energy eigenstates per unit energy interval. To make these abstract words more meaningful, we construct such density of states in detail.

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