<<对称和凝聚态物理学中的计算方法>>

图书基本信息

书名：<<对称和凝聚态物理学中的计算方法>>

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内容概要

本书与其它传统著作不同，巴塔努尼编著的《对称和凝聚态物理学中的计算方法》首次系统地介绍了现代物理学中三个非常重要的主题：对称、凝聚态物理和计算方法以及它们之间的有机联系。
本书展示了如何有效地利用群论来研究与对称性有关的实际物理问题，首先介绍了对称性，进而引入群论并详细介绍了群的表示理论、特征标的计算、直积群和空间群等，然后讲解利用群论研究固体的电子性质以及表面动力学特性，此外还包括群论在傅立叶晶体学，准晶和非公度系统中的高级应用。
本书包括大量的mathematica示例程序和150多道练习，可以帮助读者进一步理解概念。
本书是凝聚态物理，材料科学和化学专业的研究生的理想教材。

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章节摘录

版权页： 插图： The application of group theory to study physical problems and their solutions provides a formal method for exploiting the simplifications made possible by the presence of symmetry. Often the symmetry that is readily apparent is the symmetry of the system/object of interest, such as the three—fold axial symmetry of an NH3 molecule. The symmetry exploited in actual analysis is the symmetry of the Hamiltonian. When alluding to sym—metry we usually include geometrical, time—reversal symmetry, and symmetry associated with the exchange of identical particles. Con, servation laws of physics are rooted in the symmetries of the underlying space and time. The most common physical laws we are familiar with are actually marufestations of some universal symmetries. For example, the homogeneity and isotropy of space lead to the conservation of linear and angular momentum, respectively, while the homogeneity of time leads to the conservation of energy. Such laws have come to be known as universal conservation laws. As we will delineate in a later chapter, the relation between these classical symmetries and corresponding conserved quantities is beautifully cast in a theorem due to Emmy Noether. At the day—to—day working level of t. he physicist dealing with quantum mechanics, the application of symmetry restrictions leads to familiar results, such as selection rules and characteristic transformations of eigenfunctions when acted upon by symmetry operations that leave the Hamiltonian of the system invariant. In a similar manner, we expect that when a physical system/object is endowed with special symmetries, these symmetries forge conservation relations that ultimately determine its physical properties. rIYaditionally, the derivation of the physical states of a system has been performed without invoking the symmetry properties, however, the advantage of taking account of symmetry aspects is that it results in great simplification of the underlying analysis, and it provides powerful insight into the nature and the physics of the system. The mathematical framework that translates these symmetries into suitable mathematical relations is found in the theory of groups and group representations. This is the subject we will try to elucidate throughout the chapters of this book. We kn, ozu this to be true because sinx is an odd function；sin（—x）=—sin（x）. In evaluating this integral, we have taken advantage of the asymmetry of its integrand. In order to cast this problem in the language of symmetry we introduce two mathematical operations：/, which we will identify later with the operation of inversion, and which, for now, changes the sign of the argument of a function, i. e. If（x）=f（—x）；and E, which is an identity operation, Ef（x）=f（x）. This allows us to write Figure 1. 1 shows schematically the plane of integration, with q3 and 8 indicating the sign of the function sin x. We may introduce a more complicated integrand function f（x, y）, and carry the integration over the equilateral triangular area shown in Figure 1. 2.