



Crystal Symmetry, Lattice Vibrations and Optical Spectroscopy of Solids: A Group Theoretical Approach

Baldassare Di Bartolo, Richard C Powell

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This book provides a comprehensive treatment of the two fundamental aspects of a solid that determine its physical properties: lattice structure and atomic vibrations (phonons). The elements of group theory are extensively developed and used as a tool to show how the symmetry of a solid and the vibrations of the atoms in the solid lead to the physical properties of the material. The uses of different types of spectroscopy techniques that elucidate the lattice structure of a solid and the normal vibrational modes of the atoms in the solid are described. The interaction of light with solids (optical spectroscopy) is described in detail including how lattice symmetry and phonons affect the spectral properties and how spectral properties provide information about the material's symmetry and normal modes of lattice vibrations. The effects of point defects (doping) on the lattice symmetry and atomic vibrations and thus the spectral properties are discussed and used to show how material symmetry and lattice vibrations are critical in determining the properties of solid state lasers.

Contents:

- ***Symmetry of Crystals***
 - Introduction
 - Concepts of Group Theory
 - Crystal Symmetries
 - Group Theoretical Treatment of Crystal Symmetries
 - Scattering of X-Rays by Crystals
- ***Lattice Vibrations of Crystals***
 - Lattice Vibrations of Crystals
 - Thermodynamics of Lattice Vibrations
 - Effects of Lattice Vibrations on X-Ray Scattering and Neutron Scattering
- ***Optical Spectroscopy of Crystals:***
 - Interaction of Radiation with Matter
 - Optical Spectra of Impurities in Solids I
 - Optical Spectra of Impurities in Solids II
 - Interaction of Light with Lattice Vibrations: Infrared Absorption and Inelastic Light Scattering
 - Lattice Vibrations and Lasers

Readership: This book is an ideal upper undergraduate/graduate textbook for students in solid state physics courses as well as researchers in this area.

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