



# The Physics of Structural Phase Transitions

*Minoru Fujimoto*

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## **The Physics of Structural Phase Transitions** Minoru Fujimoto

Phase transitions in which crystalline solids undergo structural changes present an interesting problem in the interplay between the crystal structure and the ordering process. This text, intended for readers with some prior knowledge of condensed-matter physics, emphasizes the basic physics behind such spontaneous structural changes in crystals. Starting with the relevant thermodynamic principles, the book discusses the nature of order variables and their collective motion in a crystal lattice; in a structural phase transition a singularity in such a collective mode is responsible for the lattice instability, as revealed by soft phonons. This mechanism is analogous to the interplay of a charge-density wave and a periodically deformed lattice in low-dimensional conductors. The text also describes experimental methods for modulated crystal structures and gives examples of structural changes in representative systems. The book is divided into two parts. The first, theoretical, part includes such topics as: the Landau theory of phase transitions; statistics, correlations and the mean-field approximation; pseudospins and their collective modes; soft lattice modes and pseudospin condensates; lattice imperfections and their role in the phase transitions of real crystals. The second part discusses experimental studies of modulated crystals using x-ray diffraction, neutron inelastic scattering, light scattering, dielectric measurements, and magnetic resonance spectroscopy. While the presence of modulated structures in the critical region was not particularly suggested in the published.

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