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An Emerging Tool for Pioneering

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highly precise science that does not  
easily lend itself to improvements  
through modeling, as the computations

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required to attain an accurate prediction of the microstructure and properties of work

Flux quantization experiments indicate that the carriers, Cooper pairs (pairons), in the supercurrent have charge magnitude  $2e$ , and that they

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move independently. Josephson interference in a Superconducting Quantum Interference Device (SQUID) shows that the centers of masses (CM) of pairs move as bosons with a linear dispersion relation. Based on this evidence we develop a theory of

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superconductivity in conventional and  
mate- als from a unified point of view.  
Following Bardeen, Cooper and  
Schrieffer (BCS) we regard the phonon  
exchange attraction as the cause of  
superc- ductivity. For cuprate  
superconductors, however, we take

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account of both optical- and acoustic-phonon exchange. BCS started with a Hamiltonian containing “electron” and “hole” kinetic energies and a pairing interaction with the phonon variables eliminated. These “electrons” and “holes” were introduced formally in

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terms of a free-electron model, which we consider unsatisfactory. We define “electrons” and “holes” in terms of the cur- tures of the Fermi surface.

“Electrons” (1) and “holes” (2) are different and so they are assigned with different effective masses: Blatt,

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Schafroth and Butler proposed to explain superconductivity in terms of a Bose-Einstein Condensation (BEC) of electron pairs, each having mass  $M$  and a size. The system of free massive bosons, having a quadratic dispersion relation: and moving in three



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dimensions (3D) undergoes a BEC transition at where is the pair density.

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currently involved is proving to be a sensation, as will become apparent from what follows. Yaacov Choueka began his research career in the theory of computer science, dealing with basic questions regarding the relation between mathematical logic and automata theory. From formal

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Åkerlind University of Stockholm,

Sweden Solidification or

crystallization occurs when atoms are

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transformed from the disordered liquid state to the more ordered solid state, and is fundamental to metals processing. Conceived as a companion volume to the earlier works, Materials Processing during Casting (2006) and Physics of Functional Materials (2008), this book

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usually unknown. In mathematical terms, the oscillations are non-autonomous, reflecting the physics of open systems where the function of each oscillator is affected by its environment. Time-frequency analysis being essential, recent



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advances in this area, including wavelet phase coherence analysis and nonlinear mode decomposition, are discussed. Some applications to biology and physiology are described. Although the most important manifestation of time-

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variable oscillations is arguably in biology, they also crop up in, e.g. astrophysics, or for electrons on superfluid helium. The book brings together the research of the best international experts in seemingly very different disciplinary areas.

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enantiomerically enriched, are of potential interest as leads for new drugs. VCD Spectroscopy for Organic Chemists discusses the applications of vibrational circular dichroism (VCD) spectroscopy to the structural characterization of

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chiral organic molecules. The book provides all of the information about VCD spectroscopy that an organic chemist needs in order to make use of the technique. The authors, experts responsible for much of the existing literature in this field,

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discuss the experimental measurement of VCD and the theoretical prediction of VCD. In addition, they evaluate the advantages and limitations of the technique in determining molecular structure. Given the availability of

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commercial VCD instrumentation and quantum chemistry software, it became possible in the late 1990s for chemists to use VCD in elucidating the stereochemistries of chiral organic molecules. This book helps organic chemists become more



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aware of the utility of VCD

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relevance, is included for completeness. This book presents a single, go-to resource that will help readers understand the breadth and depth of nucleation, both in theory and in real-world examples. Offers a single, comprehensive work on water

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behavior. The third section of the book examines nucleation processes in practical situations, ranging from solid state precipitation to nucleation in biological systems to nucleation in food and drink. Nucleation in Condensed Matter is a key reference



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for an advanced materials course in phase transformations. It is also an essential reference for researchers in the field. Unified treatment of key theories, experimental evaluations and case studies Complete derivation of key models Detailed discussion of

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