4 Electron Phonon Interaction 1 Hamiltonian Derivation Of

Nuclear Electronics with Quantum Cryogenic Detectors
Proceedings of the Yamada Conference XVIII on Superconductivity in Highly Correlated Fermion Systems
The Electron-phonon Interaction in Metals
Superconductivity, Superfluids and Condensates
Exploring Electron-electron and Electron-phonon Interactions in Strongly Interacting Quantum Systems
Manifestations Of The Electron-phonon Interaction - Proceedings Of The Second Cinvestav Superconductivity Symposium
Electronic Properties of Luttinger Liquid with Electron-phonon Interaction
Atoms and Molecules in Strong External Fields
Size Effects on Polar Optical Phonon Scattering of 1-D and 2-D Electron Gas in Synthetic Semiconductors
Excitation Energy Transfer Processes in Condensed Matter
Notes on the electron-phonon interaction
Cooperative Phenomena
Length-Scale Dependent Phonon Interactions
Atlas of Point Contact Spectra of Electron-Phonon Interactions in Metals
Phonon Scattering in Condensed Matter VII
ELECTRON-PHONON INTERACTION AND ITS EFFECTS IN HEAVY FERMION SYSTEMS
Scientific and Technical Aerospace Reports
Electron-phonon Interaction in Oxide Superconductors
Electron-phonon Interaction And Lattice Dynamics In High Tc Superconductors
Superconducting Materials for High Energy Colliders
Electron-Phonon Interaction in Conventional and Unconventional Superconductors
Superconductivity
Phonons in Condensed Materials
Field Theories in Condensed Matter Physics
Electrons and Phonons
Electron-phonon Interactions in Low-dimensional Structures
Physical Properties of High Temperature Superconductors IV
Electron Phonon Interactions
Electron Phonon Interactions
Quantum Transport Theory
Polarons
Electron-Phonon Interactions and Phase Transitions
Effective Models for Low-Dimensional Strongly Correlated Systems
High Magnetic Fields
Electron-phonon Interactions in Novel Nanoelectronics
Effect of Electron-phonon Interaction on Electron Velocity in Gallium Nitride

Solid State Physics
Alkali-doped Fullerides: Narrow-band Solids With Unusual Properties
Nanophononics

SELINA DANIELLE

Nuclear Electronics with Quantum Cryogenic Detectors Springer Science & Business Media This volume contains the proceedings of the Seventh International Conference on Phonon Scattering in Condensed Matter held August 3-7, 1992, at Cornell University in Ithaca, NY, USA. The preceding conferences were held at: St. Maxime and Paris (France) 1972, Nottingham (UK) 1975, Providence (USA) 1979, Stuttgart (Germany) 1983, Urbana (USA) 1986, and Heidelberg (Germany) 1989. The Heidelberg conference was held jointly with the Third International Con ference on Phonon Physics. The next conference, to be held in August, 1995, in Sapporo, Japan, and hosted by Professor T. Nakayama and his colleagues, will also be such a joint conference. This conference was attended by 227 scientists from 27 countries, and covered all aspects of phonon scattering in condensed matter, ranging from the more traditional topics of thermal conductivity, Kapitza resistance, and ballistic phonon propagation to the recently added topics, such as electron-phonon interaction in high-T c superconductors, the use of phonons in particle detection, and phonons in confined geometries. The 207 papers arranged in 11 chapters in this volume are a cross section of the present activities in the quite obviously vibrant field of phonons and their interactions.

Proceedings of the Yamada Conference XVIII on Superconductivity in Highly Correlated Fermion Systems Litres Applying a unified quantum approach, contributors offer fresh insights into the theoretical developments in the excitation energy transfer processes in condensed matter. This comprehensive volume examines Frenkel and Wannier excitonic processes; rates of excitonic processes; theory of laser sputter and polymer ablation; and polarons, excitonic polarons and self-trapping.

The Electron-phonon Interaction in Metals Springer Science & Business Media Contents:Lattice Vibrations of the Cuprate Superconductors (W Reichardt et al)Evidence of Strong Electron-Phonon Interaction from the Infrared Spectra of YBa2Cu3O7 (T Timusk & D B Tanner)Electron-Phonon Interaction and Infrared Spectra of High Temperature Superconductors (O V Dolgov et al)Tunneling Studies of Bimuthate and Cuprate Superconductors (J F Zasadzinski et al)Phonon Mechanism of the High Tc Superconductivity Based on the Tunneling Structure (D Shimada et al)Lattice Instabilities in High Temperature Superconductors: The X Tilt Point Energy Surface for La2-xBaxCuO4 (W E Pickett et al)Structural Instability and Strong Coupling in Oxide Superconductors (N M Plakida)On the Isotope Effect (J P Carbotte)Electron-Phonon

Coupling, Oxygen Isotope Effect and Superconductivity in Ba1-xKxBio3 (C K Loong et al)Weak Coupling Theory of the High-Tc Superconductors Based on the Electron-Phonon Interaction (J Labbé)Phonon Self-Energy Effects in Migdal-Eliashberg Theory (F Marsiglio)Electron-Phonon Interaction and Superconductivity in BaxK1-xBiO3 (K Motizuki et al)The Effect of Strong Coulomb Correlations on Electron-Phonon Interactions in the Copper Oxides: Implications for Transport (J H Kim et al)Zinc Substitution Effects on the Superconducting Properties for Ld1.85Ce0.15CuO4-δ (V García-Vázquez et al)Manifestations of the e-ph Interaction: A Summary (R Baquero) Readership: Condensed matter physicists, applied physicists, chemists, electrical engineers and materials scientists. keywords: **Superconductivity, Superfluids and Condensates** World Scientific
Proceedings of the April 1997 seminar. The designation strong fields applies to external static magnetic and/or electric fields that are sufficiently intense to cause alterations in atomic or molecular structure and dynamics. Thirty-eight contributions discuss the behavior and properties of atoms in strong static fields, the fundamental aspects and electronic structure of molecules in strong magnetic fields, the dynamics and aspects of chaos in highly excited Rydberg atoms in external fields, matter in the atmosphere of astrophysical objects (white dwarfs, neutron stars), and quantum nanostructures in strong magnetic fields. Contributors hail from such disparate fields as atomic and molecular physics, theoretical chemistry, and astrophysics. Annotation copyrighted by Book News, Inc., Portland, OR
Exploring Electron-electron and Electron-phonon Interactions in Strongly Interacting Quantum Systems World Scientific
The study of cooperative phenomena is one of the dominant features of contem porary physics. Outside physics it has grown to a huge field of interdisciplinary investigation, involving all the natural sciences from physics via biology to socio logy. Yet, during the first few decades following the advent of quantum theory, the pursuit of the single particle or the single atom, as the case may be, has been so fascinating that only a small number of physicists have stressed the importance of collective behaviour. One outstanding personality among these few is Professor HERBERT FROHLICH. He has made an enormous contribution to the modern concept of cooperativity and has stimulated a whole generation of physicists. Therefore, it seemed to the editors very appropriate to dedicate a volume on "cooperative phenomena" to him on the occasion of his official retirement from his university duties. Nevertheless, in the course of carrying out this project, the editors have been somewhat amazed to find that they have covered the essentials of contemporary physics and its im pact on other scientific disciplines. It thus becomes clear how much HERBERT FROHLICH has inspired research workers and has acted as a stimulating discussion partner for others. FROHLICH is one of those exceptional scientists who

have wor ked in quite different fields and given them an enormous impetus. Unfortunately, the number of scientists of such distinctive personality has been decreasing in our century. *Manifestations Of The Electron-phonon Interaction - Proceedings Of The Second Cinvestav Superconductivity Symposium* Cambridge University Press
The ELOISATRON (ELN) Project aims at a future proton supercollider with 100-500 TeV energy per beam and 1034-1036 cm-2s-1 luminosity. While the Large Hadron Collider (LHC) is being implemented at CERN, it is very timely to study the feasibility of the next generation of hadron colliders at the extreme limits of energy and luminosity. In this respect, the achievement of extremely high magnetic fields and the production of accelerating rf cavities with very low losses are a crucial point in the actual construction design of such a collider. The search for superconducting materials with suitable properties to be used in this field has gained a new impulse after the discovery of the so-called high temperature superconducting compounds (HTSCs) with superconducting critical temperatures higher than 100 K. Besides the critical temperatures, the transport performances of this class of compounds are still very far from allowing applications in extremely high energy colliders. On the other hand, in the last few years, the technological and scientific improvements obtained for both the HTSCs and the conventional superconducting materials are very promising.This book reviews the recent status of R&D on the rising generation of superconducting materials for accelerator magnets and cavities, and discusses novel aspects and ideas in this domain. **Electronic Properties of Luttinger Liquid with Electron-phonon Interaction** Cambridge University Press
This monograph is a radical departure from the conventional quantum mechanical approach to electron-phonon interactions. It translates the customary quantum mechanical analysis of the electron-phonon interactions carried out in Fourier space into a predominantly classical analysis carried out in real space. Various electron-phonon interactions such as the polar and nonpolar optical phonons, acoustic phonons that interact via deformation potential and via the piezoelectric effect and phonons in metals, are treated in this monograph by a single, relatively simple “classical” model. This model is shown to apply to electron interactions with the deep lying X-ray levels of atoms, with plasmons and with Cerenkov radiation. The unifying concept that applies to all of these phenomena is a new definition of a coupling constant. The essentially classical interaction of an electron with its surrounding is clearly brought out to be the cause of spontaneous emission of phonons. The same concept also applies to the case of spontaneous emission of photons. While the bulk of this monograph deals with quanta of phonons and quanta of photons, a discussion of the acousto electric effect which is a purely classical phenomenon is presented. The newly defined coupling constant turns out to be valid too for this discussion. This universality of the

coupling constant goes far beyond. It is equally applicable to amorphous materials. This significant application gives an analytic formulation of mobility in amorphous materials. Contents: Energy Losses of Hot ElectronsField and Temperature Dependence of Electronic TransportEnergy Losses by Hot Electrons in Solids: A Semiclassical Approach Readership: Physicists, solid state physicists and electronic engineers.

Atoms and Molecules in Strong External Fields CRC Press

Written for researchers and academics, this monograph provides a detailed introduction to the strong-coupling theory of high-temperature superconductivity.

Size Effects on Polar Optical Phonon Scattering of 1-D and 2-D Electron Gas in Synthetic Semiconductors Routledge

A distinctive introduction to the principles governing polaron science for experimental and theoretical graduate students and researchers.

Excitation Energy Transfer Processes in Condensed Matter World Scientific

This NATO Advanced Study Institute was the fourth in a series devoted to the subject of phase transitions and instabilities with particular attention to structural phase transforma~ions. Beginning wi th the first Geilo institute in 19'(1 we have seen the emphasis evolve from the simple quasiharmonic soft mode description within the Landau theory, through the unexpected spectral structure re presented by the "central peak" (1973), to such subjects as melting, turbulence and hydrodynamic instabilities (1975). Sophisticated theoretical techniques such as scaling laws and renormalization group theory developed over the same period have brought to this wide range of subjects a pleasing unity. These institutes have been instrumental in placing structural transformations clearly in the mainstream of statistical physics and critical phenomena. The present Geilo institute retains some of the counter cul tural flavour of the first one by insisting whenever possible upon peeking under the skirts of even the most successful phenomenology to catch a glimpse of the underlying microscopic processes. Of course the soft mode remains a useful concept, but the major em phasis of this institute is the microscopic cause of the mode softening. The discussions given here illustrate that for certain important classes of solids the cause lies in the electron phonon interaction. Three major types of structural transitions are considered. In the case of metals and semimetals, the electron phonon interaction relie6 heavily on the topology of the Fermi surface.

Notes on the electron-phonon interaction Springer Science & Business Media

This three-volume book provides a comprehensive review of experiments in very strong magnetic fields that can only be generated with very special magnets. The first volume is entirely devoted to the technology of laboratory magnets: permanent, superconducting, high-power water-cooled and hybrid; pulsed magnets, both nondestructive and destructive (megagauss fields). Volumes 2 and 3 contain reviews of the different areas of research where strong magnetic fields are an essential research tool. These volumes deal primarily

with solid-state physics; other research areas covered are biological systems, chemistry, atomic and molecular physics, nuclear resonance, plasma physics and astrophysics (including QED).
Cooperative Phenomena
World Scientific
This book presents a comprehensive description of phonons and their interactions in systems with different dimensions and length scales. Internationally-recognized leaders describe theories and measurements of phonon interactions in relation to the design of materials with exotic properties such as metamaterials, nano-mechanical systems, next-generation electronic, photonic, and acoustic devices, energy harvesting, optical information storage, and applications of phonon lasers in a variety of fields. The emergence of techniques for control of semiconductor properties and geometry has enabled engineers to design structures in which functionality is derived from controlling electron behavior. As manufacturing techniques have greatly expanded the list of available materials and the range of attainable length scales, similar opportunities now exist for designing devices whose functionality is derived from controlling phonon behavior. However, progress in this area is hampered by gaps in our knowledge of phonon transport across and along arbitrary interfaces, the scattering of phonons with crystal defects, interface roughness and mass-mixing, delocalized electrons/collective electronic excitations, and solid acoustic vibrations when these occur in structures with small physical dimensions. This book provides a comprehensive description of phonons and their interactions in systems with different dimensions and length scales. Theories and measurements of phonon interactions are described in relation to the design of materials with exotic properties such as metamaterials, nano-mechanical systems, next-generation electronic, photonic, and acoustic devices, energy harvesting, optical information storage, and applications of phonon lasers in a variety of fields.
Length-Scale Dependent Phonon Interactions
Springer Science & Business Media
List of Contributors p. ix 1 Introduction L.J. Challis p. 1 2 Energy relaxation by hot two-dimensional carriers in zero magnetic field A.J. Kent and J.K. Wigmore p. 5 2.1 Experimental principles p. 5 2.2 Emission of acoustic phonons by 2D carriers p. 13 2.3 Energy relaxation via optic phonons p. 27 2.4 Phonon pulse measurements p. 38 2.5 Higher subband occupancy p. 49 2.6 Other 2D systems p. 51 2.7 Conclusions p. 53 3 Phonon interactions with magnetically quantized two-dimensional carrier systems: the integer and fractional quantum Hall states C.J. Mellor and W. Dietsche and L.J. Challis p. 59 3.1 Introduction p. 59 3.2 Ballistic phonon techniques p. 63 3.3 Theoretical investigations of phonon interaction with magnetically quantized 2DEGs p. 64 3.4 Experimental studies of the phonon emission from magnetically quantized 2DEGs p. 69 3.5 Experimental studies of phonon absorption by magnetically quantized 2DEGs p. 75 3.6 Introduction to the FQHE p. 80 3.7 Electron-phonon interaction in the fractional quantum Hall

regime p. 82 3.8 SAW studies of quantum Hall states p. 90 3.9 Conclusions p. 107 4 Carrier-phonon interactions in semiconductor quantum dots and wires S.A. Cavill and P. Hawker and A.J. Kent p. 115 4.1 Introduction p. 115 4.2 Electron-phonon interaction in QWRs p. 116 4.3 QDs p. 137 4.4 Conclusions p. 145 5 Phonon drag thermopower of low-dimensional systems R. Fletcher and E. Zaremba and U. Zeitler p. 149 5.1 General introduction p. 149 5.2 Experimental results at zero magnetic field p. 165 5.3 Behaviour of 2D systems in magnetic fields p. 173 5.4 Conclusions and outlook p. 180 6 Phonon-assisted tunnelling F.F. Ouali and L.J. Challis p. 185 6.1 Introduction p. 185 6.2 DBRTDs and TBRTDs p. 187 6.3 SLs p. 209 6.4 Related transport processes p. 227 6.5 Conclusions p. 231 7 Exciton-phonon interaction in quantum wells A.V. Akimov p. 239 7.1 Introduction p. 239 7.2 Role of phonons in exciton dynamics p. 247 7.3 Heating of 2D exciton gas by non-equilibrium acoustic phonons p. 254 7.4 Acoustic phonon-assisted tunnelling in double QWs p. 260 7.5 Conclusions and outlook p. 264 8 Quantized thermal conductance of acoustic phonons in nanowires M.P. Blencowe p. 269 8.1 Introduction p. 269 8.2 Derivation of the Landauer formula for the thermal conductance p. 270 8.3 Measurement of the quantum of thermal conductance p. 275 8.4 Conclusion p. 281 Index p. 283 Applications.

Atlas of Point Contact Spectra of Electron-Phonon Interactions in Metals World Scientific

The application of field theoretic techniques to problems in condensed matter physics has generated an array of concepts and mathematical techniques to attack a range of problems such as the theory of quantum phase transitions, the quantum Hall effect, and quantum wires. While concepts such as the renormalization group, topology, and bosonization h

Phonon Scattering in Condensed Matter VII Nova Science Publishers

The characteristics of electrical contacts have long attracted the attention of researchers since these contacts are used in every electrical and electronic device. Earlier studies generally considered electrical contacts of large dimensions, having regions of current concentration with diameters substantially larger than the characteristic dimensions of the material: the interatomic distance, the mean free path for electrons, the coherence length in the superconducting state, etc. [110]. The development of microelectronics presented to scientists and engineers the task of studying the characteristics of electrical contacts with ultra-small dimensions. Characteristics of point contacts such as mechanical stability under continuous current loads, the magnitudes of electrical fluctuations, inherent sensitivity in radio devices and nonlinear characteristics in connection with electromagnetic radiation can not be understood and altered in the required way without knowledge of the physical processes occurring in contacts. Until recently it was thought that the electrical conductivity of contacts with direct conductance (without

tunneling or semiconducting barriers) obeyed Ohm's law. Nonlinearities of the current-voltage characteristics were explained by joule heating of the metal in the region of the contact. However, studies of the current-voltage characteristics of metallic point contacts at low (liquid helium) temperatures [142] showed that heating effects were negligible in many cases and the nonlinear characteristics under these conditions were observed to take the form of the energy dependent probability of inelastic electron scattering, induced by various mechanisms.

ELECTRON-PHONON INTERACTION AND ITS EFFECTS IN HEAVY FERMION SYSTEMS

World Scientific

Heat in most semiconductor materials, including the traditional group IV elements (Si, Ge, diamond), III–V compounds (GaAs, wide-bandgap GaN), and carbon allotropes (graphene, CNTs), as well as emerging new materials like transition metal dichalcogenides (TMDCs), is stored and transported by lattice vibrations (phonons). Phonon generation through interactions with electrons (in nanoelectronics, power, and nonequilibrium devices) and light (optoelectronics) is the central mechanism of heat dissipation in nanoelectronics. This book focuses on the area of thermal effects in nanostructures, including the generation, transport, and conversion of heat at the nanoscale level. Phonon transport, including thermal conductivity in nanostructured materials, as well as numerical simulation methods, such as phonon Monte Carlo, Green’s functions, and first principles methods, feature prominently in the book, which comprises four main themes: (i) phonon generation/heat dissipation, (i) nanoscale phonon transport, (iii) applications/devices (including thermoelectrics), and (iv) emerging materials (graphene/2D). The book also covers recent advances in nanophononics—the study of phonons at the nanoscale. Applications of nanophononics focus on thermoelectric (TE) and tandem TE/photovoltaic energy conversion. The applications are augmented by a chapter on heat dissipation and self-heating in nanoelectronic devices. The book concludes with a chapter on thermal transport in nanoscale graphene ribbons, covering recent advances in phonon transport in 2D materials. The book will be an excellent reference for researchers and graduate students of nanoelectronics, device engineering, nanoscale heat transfer, and thermoelectric energy conversion. The book could also be a basis for a graduate special topics course in the field of nanoscale heat and energy.

Scientific and Technical Aerospace Reports

Academic Press

Electron-electron and electron-phonon interactions play fundamental roles in condensed matter physics. Strong correlations among electrons and between electrons and phonons lead to beautiful emergent phenomena both in materials and in the models used to describe them. Unfortunately, the complexity induced from the combination of interactions and large numbers of degrees of freedom makes

analytically solving these models very difficult, even when greatly simplified. As a consequence, many important questions in many-body physics remain open. For example, the discoveries of charge density wave (CDW) in the pseudogap phase of the unconventional high-temperature cuprate superconductors motivate on-going research on electron-phonon interactions and its effects on the off-diagonal long-range order (ODLRO). In conventional superconductors, the attractive interaction between electrons which is mediated by the electron-phonon interaction is essential for the formation of Cooper pairs. However, if the electron-phonon interaction is sufficiently strong, charge order emerges near commensurate filling to compete with superconductivity. In this thesis, we use a combination of numerical and analytical methods to understand this sort of interplay between different types of order in the microscopic and macroscopic behavior of many-body systems. In Chapter 1, we introduce the Hubbard and Holstein Hamiltonians and the some of the exotic phases and phase transitions which they describe. We also build up some of the connections between numerical solutions of these models and experimental results for superconducting, charge, and spin order. In Chapter 2 and 3, we set up the frameworks of quantum Monte Carlo (QMC) algorithms and machine learning (ML) methods. We show how to translate a quantum-mechanical problem into an algorithm with analytical analysis encoded in it, which can be widely applied to various models and physics. In Chapter 4 and 5, we quantitatively determine the phase diagrams of one dimensional electron-phonon models where electrons have a long-range coupling to phonons as well as repulsive electron-electron interactions. We analyze the resulting metallic, Mott insulator, Peierls insulator phases, as well as the phase separation which we show often arises from momentum-dependent electron-phonon coupling. Although much work has been done on the extended Hubbard model, our research on including electron-phonon interactions pushes the field in a new direction. In Chapter 6, we describe the first study of the interplay between electron-phonon interaction and the effects of randomness. Our central result is a somewhat unexpected one: the suppression of the charge density wave correlations in the half-filled Holstein model by disorder can stabilize a superconducting phase. In Chapter 7, we use QMC and cutting-edge ML methods to identify phase transitions involving 'off-diagonal' order parameters using 'diagonal' order parameter descriptors. Our study has implications for the exploration of strong correlations using quantum gas microscopy (QGM). Chapter 8 summarizes some of the key results of this thesis, and points areas of investigation which would be important to pursue further. The material presented in Chapters 3, 4 and 5 of this dissertation is based on two published articles in Physical Review B, references [1, 2], and one manuscript which has been submitted and is under review at Physical

Review Letters, reference [3]. Chapter 7 is based on reference [4], which is in preparation.

Electron-phonon Interaction in Oxide Superconductors Oxford University Press

These proceedings cover the possible manifestations of electron-phonon interactions in understanding high Tc superconductivity. The results of measurements of different experimental methods have been analysed, and the role played by electrons in superconductivity, taking into account the van Hove singularity, has also been discussed. The pairing of electrons by other bosonic excitations, as well as the effects of strong local electron-lattice interactions are reviewed. Another important point is the ab initio calculations discussed by several authors that remark the importance of electron-phonon effects for high Tc superconductivity.

Electron-phonon Interaction And Lattice Dynamics In High Tc Superconductors Springer Science & Business Media

This volume contains two chapters of direct interest for applications: The magnetic vortex states and transformations and the effects of c-axis coupling on the transport properties. In addition, the isotope effect is reviewed, since reliable data on ultra-pure samples are now available. The lattice vibrations (phonons) have been explored extensively by inelastic neutron scattering and infrared absorption and these types of data are reviewed as well. The interesting properties of the superconducting doped fullerenes are described; some of their most fundamental properties are shared by the superconducting cuprates. This book with its subject index, like the earlier three volumes in this series, will be found useful both by people entering the field and by workers who are already active in it.

Superconducting Materials for High Energy Colliders World Scientific

Superconductivity, provides a basic introduction to one of the most innovative areas in condensed matter physics today. This book includes ample tutorial material, including illustrations, chapter summaries, graded problem sets, and concise examples. This book is part of the Oxford Master Series in Condensed Matter Physics.