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Title: Charge effects and Josephson plasma resonance on planar defects in high-temperature superconductors

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Abstract: We show that planar crystalline defects parallel to the ab planes in high-T-c superconductors (HTS) give rise to a localized Josephson plasma mode formed by a collective Coulomb interaction of interlayer junctions. This results in a pronounced satellite line in the real part of the complex resistivity R(omega), whose position and amplitude depend on the critical current density J(0) and on the parameters of the charge interlayer coupling. The narrowness of the zero-field plasma peak in ReR(omega) enables one to probe the pairing symmetry of the interplane coupling by extracting the angular dependence of J(0)(theta) across twist grain boundaries in HTS bicrystals.

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Abstract: Several experimental studies have shown the presence of spatially inhomogeneous phase coexistence of superconducting and non-superconducting domains in low dimensional organic superconductors. The superconducting properties of these systems are found to be strongly dependent on the amount of disorder introduced in the sample regardless of its origin. The suppression of the superconducting transition temperature T-c shows a clear discrepancy with the result expected from the Abrikosov-Gor'kov law giving the behavior of T-c with impurities. On the basis of the time dependent Ginzburg-Landau theory, we derive a model to account for this striking feature of T-c in organic superconductors for different types of disorder by considering the segregated texture of the system. We show that the calculated T-c quantitatively agrees with experiments. We also focus on the effect of superconducting fluctuations on the upper critical fields H-c2 of layered superconductors showing slab structure where superconducting domains are sandwiched by non-superconducting regions. We found that H-c2 may be strongly enhanced by such fluctuations.

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Title: Electrosynthesis of lead nanoparticles on template free gold surface by potentiostatic triple pulse technique

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Abstract: Experiments were carried out to synthesize lead nanoparticles (PbNPs) on a template free gold plated quartz crystal (Au-QC) surface by employing potentiostatic triple pulse strategy. The pulse potentials were chosen from cyclic voltammetry (CV) and electrochemical quartz crystal microbalance (EQCM) studies of Pb(II)/Pb couple in 0.1 M HClO(4). The electrodeposited PbNPs were characterized ex situ independently by the X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS) and atomic force microscopy (AFM). The results obtained suggested the presence of chemisorbed oxygen on the surface of PbNPs. The influence of pulse parameters (viz. nucleation pulse duration, growth pulse duration and growth pulse potential) was investigated on the size, particle density and monodispersity of the deposited PbNPs. The studies revealed that, while the particle density of PbNPs increased, the size and monodispersity of PbNPs decreased with the increase in the nucleation pulse duration. The size and polydispersity of PbNPs increased on increasing the growth pulse duration. However, the size and polydispersity of PbNPs both decreased on shifting the growth pulse potential towards the lesser negative potentials. The influence of the growth pulse potential on the size and monodispersity of PbNPs became significant at lesser negative potentials as compared to the threshold potential for nucleation of PbNPs. (c) 2009 Elsevier Ltd. All rights reserved.

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Cited Reference Count: 104
Abstract: The main stages of development of the theory of superconducting systems with overlapping energy bands are formulated. The main references of the classical papers of the authors of this theory (Prof. V.A.Moskalenko and his co-workers) are listed. The list also includes papers related to high-temperature superconductivity Some peculiarities of the two-band model, which give qualitatively new results in comparison with the usual one-band model, are described. The application of the two-band model for the description of the thermodynamical and magnetical properties of the compound MgB2 is also discussed.
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Abstract: We present a microscopic derivation of the effect of current flow on a system near a superconductor-metal quantum critical point. The model studied is a 2d itinerant electron system where the electrons interact via an attractive interaction and are coupled to an underlying normal metal substrate which provides a source of dissipation and also provides a source of inelastic scattering that allows us to reach a nonequilibrium steady state. A nonequilibrium Keldysh action for the superconducting fluctuations on the normal side is derived. Current flow, besides its minimal coupling to the order parameter, is found to give rise to two effects. One is a source of noise that acts as an effective temperature T(eff)=eE nu(F)tau(sc), where E is the external electric field, nu(F) is the Fermi velocity, and tau(sc) is the escape time into the normal metal substrate. Second current flow also produces a drift of the order parameter. Scaling equations for the superconducting gap and the current are derived and are found to be consistent with previous phenomenological treatments as long as a temperature T similar to T(eff) is included. The current induced drift is found to produce additional corrections to the scaling which are smaller by a factor of O(1/E(F)tau(sc)) E(F) being the Fermi energy.

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Abstract: We have performed systematic high-resolution angle-resolved photoemission spectroscopy (ARPES) on two novel boride compounds, MgB2 and CaB6, to study the electronic structure near the Fermi level relevant to the anomalous physical properties (superconductivity and ferromagnetism) observed in these compounds. In MgB2, we have succeeded in separately observing two superconducting gaps which originate in the sigma and pi bands, respectively, and thereby established the two-band superconductivity. ARPES measurements on AlB2, which is a non-superconducting isostructural reference compound of MgB2 with an additional electron in a unit cell, indicates the importance of the s band for the superconductivity. In CaB6, we observed an energy gap of 1 eV at the X point in the Brillouin zone, which suggests that CaB6 is intrinsically a large-gap semiconductor. This observation requires reconsideration of the excitonic-insulator model to explain the anomalous ferromagnetism in CaB6.

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Abstract: MgB2 shows the highest superconducting transition temperature among intermetallic compounds. Angle-resolved photoemission spectroscopy revealed their electronic structure, and the result is well explained within a simple band picture except for one band. Other photoemission studies on related materials of AlB2 and CaAlSi also show an extra band similar to that in MgB2. The direct observation of the superconducting gap confirmed a two-gap superconductivity. The larger and smaller gaps open at the sigma and pi bands, respectively. The carbon substitution effect on the two gaps was evaluated by using sub-meV photoemission spectroscopy. (c) 2007 Elsevier B.V. All rights reserved.
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Abstract: Superconducting compounds of the family Hg-Ba-Ca-Cu-O have been the subject of intense study since the current record holder for the highest critical temperature of a superconductor belongs to this class of materials. Thin films of the compound with two adjacent copper-oxide layers and a critical temperature of about 120 K were prepared by a two-step process that consists of the pulsed-laser deposition of precursor films and the subsequent annealing in mercury-vapor atmosphere. Like some other high-temperature superconductors, Hg-Ba-Ca-Cu-O exhibits a specific anomaly of the Hall effect, a double-sign change of the Hall coefficient close to the superconducting transition. We have investigated this phenomenon by measurements of the Hall effect at different angles between the magnetic field direction and the crystallographic c axis. The results concerning the upper part of the transition, where the first sign change occurs, are discussed in terms of the renormalized fluctuation model for the Hall conductivity, adapted through the field rescaling procedure in order to take into account the arbitrary orientation of the magnetic field.

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Abstract: For various sample geometries (slabs, cylinders, spheres, hypercubes), de Gennes' boundary condition parameter b is used to study its effect upon the transition temperature T-c of a superconductor. For b > 0 the order parameter at the surface is decreased, and as a consequence Tc is reduced, while for b < 0 the order parameter at the surface is increased, thereby enhancing T-c of a specimen in zero magnetic field. Exact solutions, derived by Fink and Haley (Int. J. mod. Phys. B, 17, 2171 (2003)), of the order parameter of a slab of. nite thickness as a function of temperature are presented, both for reduced and enhanced transition (nucleation) temperatures. At the nucleation temperature the order parameter approaches zero. This concise review closes with a link established between de Gennes' microscopic boundary condition and the Ginzburg-Landau phenomenological approach, and a discussion of some relevant experiments. For example, applying the boundary condition with b < 0 to tin whiskers elucidates the increase of T-c with strain.

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Author(s): Citro, R (Citro, R); Angilella, GGN (Angilella, GGN); Marinaro, M (Marinaro, M); Pucci, R (Pucci, R)

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Abstract: We study the dependence on filling and pressure of the superconducting and ferromagnetic critical temperatures of the ruthenocuprates, within the two-band model. At zero pressure, we find separate regions of coexistence of superconductivity and ferromagnetism as a function of filling, with contiguous regions merging together as the pressure increases. As a function of pressure, a stronger enhancement of the magnetic phase results in a reduced pressure effect on the superconducting critical temperature. A comparison with recent experiments on the determination of the critical temperatures as a function of the pressure is also discussed.

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Abstract: Photoemission spectroscopy measurements of MgB2 are reviewed. From angle-resolved photoemission spectroscopy, band dispersion is observed as is theoretically predicted, suggesting that the electronic structure of MgB2 is well described within band theory. From angle-integrated photoemission spectroscopy, a clear peak ascribed to the superconducting coherent peak is observed. The shape of the spectral line shape is consistent with the presence of s-wave gap(s). The estimated size of superconducting gap is close to the conventional BCS prediction, supporting the idea that this material is an electron-phonon mediated superconductor. At the same time, the presence of second gap with a smaller size is indicated by the high-resolution photoemission spectroscopy. (C) 2002 Elsevier Science B.V. All rights reserved.

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Abstract: The Josephson plasma resonance (JPR), which is a phase collective excitation mode representing the Cooper-pair oscillation mode, is a most powerful means to study the vortex state in Josephson coupled high-T-c superconductors (HTSC). In this paper, we report the detailed and quantitative study of the interlayer quantum phase coherence in the vortex liquid, Bragg glass and vortex glass phases of Bi2Sr2CaCu2O8+delta by the JPR. We also provide a quantitative discussion on the nature of the phase transitions among these vortex phases. On the basis of these results, we discuss the vortex phase diagram of HTSC. (C) 2001 Elsevier Science B.V. All rights reserved.

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Abstract: We study theoretically the dynamics of a fluxon lattice (FL) in two coupled Josephson junctions. We show that when the velocity of the moving FL exceeds certain values (V-a.b), sharp resonances arise in the system which are related to the excitation of the optical and acoustic collective modes. In the interval (V-a, V-b) a reconstruction of the FL occurs. We also establish that one can excite localized nonlinear distortions (dislocations) which may propagate through the FL and carry an arbitrary magnetic flux.

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Cited Reference Count: 40
Abstract: We consider wave propagation inside an anisotropic superconducting film sandwiched between two semi-infinite nonconducting bounding dieletric media such that along the c axis, perpendicular to the surfaces, there is a plasma frequency omega(p) below the superconducting gap. Propagation is assumed to be parallel to the surfaces in the dielectric media, where amplitudes decay

exponentially, Below omega(p), the amplitude also evanesces inside the film. and we retrieve the experimentally measured lower dispersion relation branch, omega(proportional to)root beta, and the recently proposed higher frequency branch, omega(proportional to)1/root beta. Above omega(p), propagation is of the guided a wave type, i.e.: a dispersive plane wave confined inside the film that reflects into the dielectric interfaces, and the modes are approximately described by omega approximate to omega(p) root 1 + (beta/beta(0))(2), where beta(0) is discussed hen.

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Abstract: The Pippard coherence length xi(0) (the size of a Cooper pair) in two extreme type-I superconductors (In and Sn) was determined directly through high-resolution measurement of the nonlocal electrodynamic effect combining low-energy muon spin rotation spectroscopy and polarized neutron reflectometry. The renormalization factor Z = m*(cp)/2m (m*(cp) and m are the mass of the Cooper pair and the electron, respectively) resulting from the electron-phonon interaction, and the temperature-dependent London penetration depth lambda(L)(T) were determined as well. An expression linking xi(0), Z, and lambda(L)(0) is introduced and experimentally verified. This expression allows one to determine experimentally the Pippard coherence length in any superconductor, independent of whether the superconductor is local or nonlocal, conventional or unconventional. DOI: 10.1103/PhysRevB.87.104508

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Author(s): Despoja, V (Despoja, V.); Mowbray, DJ (Mowbray, D. J.); Silkin, VM (Silkin, V. M.)

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Abstract: Surface state localization and hybridization on B, Mg, and Li terminated MgB2(0001) surfaces are studied within density functional theory (DFT). For the B terminated surface we find a low energy B sigma(1) surface state, a sp(z) surface state, and B sigma(2) and sigma(3) quantum well states, which are 90% localized in the topmost B layer. Our results demonstrate that by charging the B atomic layer, either by changing the surface termination or through electro-chemical doping, the B sigma surface states are shifted down in energy, filled, and delocalize through hybridization as they cross the bulk MgB2 bulk bands. On the other hand, the spz surface state should be shifted up in energy, emptied, and gain an increasingly metallic s character by adding a Mg, Mg+1, or Li terminating atomic layer. These results clearly show both the robust nature of MgB2(0001) surface states, and how their localization and energy range may be tuned by surface termination and charging, with implications for the superconducting and plasmonic behavior of MgB2.

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Title: Hysteretic jumps in the response of layered superconductors to electromagnetic fields

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Abstract: We consider here a layered superconductor subject to an externally applied moderately strong electromagnetic field. We predict hysteretic jumps in the dependence of the surface reactance of the superconductor on the amplitude H(0) of the incident electromagnetic wave. This very unusual nonlinear phenomenon can be observed in thin superconducting slabs at not very strong ac amplitudes if the frequency of the irradiating field is close to the Josephson plasma frequency. Using the set of coupled sine-Gordon equations, we derive the expression for the phase shift chi of the reflected wave and obtain the conditions for the appearance of hysteresis in the chi(H(0)) dependence.

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Abstract: In the present work we report band structure calculations for the high-temperature superconductor Nd2-xCexCuO4 in the regime of strong electronic correlations within an LDA + GTB method, which combines the local density approximation (LDA) and the generalized tight-binding method (GTB). The two mechanisms of band structure doping dependence were taken into account. Namely, the one-electron mechanism provided by the doping dependence of the crystal structure, and

the many-body mechanism provided by the strong renormalization of the fermionic quasiparticles due to the large on-site Coulomb repulsion. We have shown that, in the antiferromagnetic and in the strongly correlated paramagnetic phases of the underdoped cuprates, the main contribution to the doping evolution of the band structure and Fermi surface comes from the many-body mechanism.

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ZHANG FC, 1988, PHYS REV B, V37, P3759, DOI 10.1103/PhysRevB.37.3759
Cited Reference Count: 15
Abstract: We consider the four-band model of high-temperature superconductors with copper 3d(x2-y2) and 4s electrons and oxygen 2p(x) and 2p(y) electrons. We assume that the Coulomb repulsion between the copper 3d electrons is strong. We diagonalize the oxygen subsystem and pass to the Wannier representation for the CuO2 cluster. We study the properties of a local cell model and find its low-energy states such as the one-particle doublet and the two-particle singlet and triplet states. We consider the cell fermion delocalization because of their tunneling between the copper sites. We obtain a system of Dyson-type equations for renormalized one-particle Green's functions and discuss whether it can be simplified.
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Cited Reference Count: 39

Abstract: The non-Ohmic effect of a high electric field on the out-of-plane magnetoconductivity of a layered superconductor near the superconducting transition is studied in the frame of the Langevin approach to the time-dependent Ginzburg-Landau equation. The transverse fluctuation conductivity is computed in the self-consistent Hartree approximation for an arbitrarily strong electric field and a magnetic field perpendicular to the layers. Our results indicate that high electric fields can be effectively used to suppress the out-of-plane fluctuation conductivity in high-temperature superconductors and a significant broadening of the transition induced by a strong electric field is predicted. Extensions of the results are provided for the case when the electric field is applied at an arbitrary angle with respect to the layers, as well as for the three-dimensional anisotropic regime of a strong interlayer coupling.

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KeyWords Plus: MAGNETIC-FIELD; TRANSITION TEMPERATURE; NONLINEAR CONDUCTIVITY; GAUSSIAN FLUCTUATIONS; TRANSPORT-PROPERTIES; II SUPERCONDUCTORS; STATE; REGIME; FILMS; PARACONDUCTIVITY

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Record 71 of 149

Title: Higher harmonics of ac voltage response in narrow strips of YBa2Cu3O7 thin films: evidence for strong thermal fluctuations

Author(s): Ossandon, JG (Ossandon, JG); Sergeenkov, S (Sergeenkov, S); Esquinazi, P (Esquinazi, P); Kempa, H (Kempa, H)

Source: SUPERCONDUCTOR SCIENCE & TECHNOLOGY **Volume:** 18 **Issue:** 3 **Pages:** 325-329 **DOI:** 10.1088/0953-2048/18/3/020 **Published:** MAR 2005

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Abstract: We report on measurements of higher harmonics of the ac voltage response in strips of YBa2Cu3O7-delta thin films as a function of temperature, frequency and ac current amplitude. The third (fifth) harmonic of the local voltage is found to exhibit a negative (positive) peak at the superconducting transition temperature and their amplitudes are closely related to the slope (derivative) of the first (ohmic) harmonic. The peaks practically do not depend on frequency and no even (second Or fourth) harmonics are detected. The observed data can be interpreted in terms of ac

current induced thermal modulation of the sample temperature added to strong thermally activated fluctuations in the transition region.

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Language: English
Document Type: Article
KeyWords Plus: NONLINEAR CURRENT RESPONSE; CRITICAL-CURRENT-DENSITY; SUPERCONDUCTING FILMS; T-C; TEMPERATURE; GENERATION; TRANSPORT; FIELDS; 3RD

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Title: Measurements of the doping effects on the in-plane paraconductivity in cuprate superconductors

Author(s): Vidal, F (Vidal, F); Ramallo, MV (Ramallo, MV); Ferro, G (Ferro, G); Veira, JA (Veira, JA)

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Vidal F, 2002, EUROPHYS LETT, V59, P754, DOI 10.1209/epl/i2002-00190-3

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Abstract: We will summarize here some of our measurements of the superconducting fluctuations effects on the in-plane electrical resistivity (the so-called in-plane paraconductivity) in La2-xSrxCuO4 thin films with different Sr content. Our results suggest that these superconducting fluctuations effects are not related to the opening of a pseudogap in the normal-state of underdoped compounds.

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Author(s): Ramallo, MV (Ramallo, MV)

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VIDAL F, 1998, GAP SYMMETRY FLUCTUA, P477

Cited Reference Count: 36

Abstract: A Ginzburg-Landau-like functional is proposed reproducing the main low-energy features of various possible high-T-c superconducting mechanisms involving energy savings due to interlayer interactions. The functional may be used to relate these savings to experimental quantities. Two examples are given, involving the mean-field specific-heat jump at T-c and the superconducting fluctuations above T-c. Comparison with existing data suggests, e.g., that the increase of T-c due to the so-called interlayer tunneling (ILT) mechanism of interlayer kinetic-energy savings is negligible in optimally doped Bi2Sr2CaCu2O8+x.

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KeyWords Plus: AXIS LAYERING STRUCTURE; T-C; OXIDE SUPERCONDUCTORS; SINGLE-CRYSTALS; PENETRATION DEPTH; COOPER PAIRS; DEPENDENCE; HEAT; YBA2CU3O7-DELTA; MODEL

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Author(s): Fink, HJ (Fink, HJ); Haley, SB (Haley, SB)
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Abstract: The Ginzburg-Landau (GL) theory is recast using a Hamiltonian involving the complete kinetic energy density which requires that the surface energy must contain a term del\psi\(2) to support superconducting (SC) states. The GL equations contain two temperature t dependent parameters alpha(t) and beta(t), which are respectively the coefficients of the SC pair density proportional to \psi\(2), and the pair interaction term proportional to \psi\(4) in the free energy density. The sign of these parameters, which defines distinct solution classes, and the ratio s(t) = root\alpha\/\beta\ axe governed by the characteristics of the surface energy density. In addition to the conventional bulk superconducting states with (alpha < 0, beta > 0), anomalous superconducting states exist for all other sign combinations, including cases with beta < 0 which may exist only when surface pair interactions are significant. All possible solutions of our generalized nonlinear, one-dimensional GL equations are found analytically and applied to a thin superconducting slab which manifests the possibility of states exhibiting enhanced, diminished, and pre-wetting superconductivity. Critical currents axe determined as functions of s(t) and surface parameters. The results axe applied to critical current experiments on SNS systems.

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Author(s): Vidal, F (Vidal, F); Torron, C (Torron, C); Vina, J (Vina, J); Mosqueira, J (Mosqueira, J)

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Xue YY, 1996, PHYS REV B, V53, P2815, DOI 10.1103/PhysRevB.53.2815

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Abstract: By mainly using, just as examples, some of the results we have obtained in our group. we first noted some of the advantages and difficulties that may appear when the thermal fluctuations of the Cooper pairs and of the magnetic vortices are used as a tool (which could be nicknamed thermal fluctuation "spectroscopy", TFS) to access at a quantitative level the various central parameters describing the high temperature cuprate (HTSC) physics. Some of the ways to overcome these difficulties are also commented, in particular, in the case of the fluctuations around the T-c of the magnetic vortices in highly anisotropic HTSC. (C) 2000 Elsevier Science B.V. All rights reserved.

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Author(s): Zabolotnyy, VB (Zabolotnyy, V. B.); Evtushinsky, DV (Evtushinsky, D. V.); Kordyuk, AA (Kordyuk, A. A.); Kim, TK (Kim, T. K.); Carleschi, E (Carleschi, E.); Doyle, BP (Doyle, B. P.); Fittipaldi, R (Fittipaldi, R.); Cuoco, M (Cuoco, M.); Vecchione, A (Vecchione, A.); Borisenko, SV (Borisenko, S. V.)
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Abstract: We derive an effective quasiparticle tight-binding model which is able to describe with high accuracy the low-energy electronic structure of Sr2RuO4 obtained by means of low temperature angle resolved photoemission spectroscopy. Such an approach is applied to determine the momentum and orbital dependent effective masses and velocities of the electron quasiparticles close to the Fermi level. We demonstrate that the model can provide, among the various computable physical quantities, a very good agreement with the experimentally measured specific heat coefficient and compares well with the plasma frequency estimated from local density calculations. Its use is underlined as a realistic input in the analysis of the possible electronic mechanisms related to the superconducting state of Sr2RuO4. (C) 2013 Elsevier B.V. All rights reserved.
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Author(s): Johnston, DC (Johnston, David C.)

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Abstract: The single-band alpha-model of superconductivity (Padamsee et al 1973 J. Low Temp. Phys. 12 387) is a popular model that was adapted from the single-band Bardeen-Cooper-Schrieffer (BCS) theory of superconductivity mainly to allow fits to electronic heat capacity versus temperature T data that deviate from the BCS prediction. The model assumes that the normalized superconducting order parameter Delta(T)/Delta(0) and therefore the normalized London penetration depth lambda(L)(T)/lambda(L)(0) are the same as in BCS theory, calculated using the BCS value alpha(BCS) approximate to 1.764 of alpha equivalent to Delta(0)/k(B)T(c), where k(B) is Boltzmann's constant and T-c is the superconducting transition temperature. On the other hand, to calculate the

electronic free energy, entropy, heat capacity and thermodynamic critical field versus T, the alpha-model takes alpha to be an adjustable parameter. Here we write the BCS equations and limiting behaviors for the superconducting state thermodynamic properties explicitly in terms of alpha, as needed for calculations within the alpha-model, and present plots of the results versus T and alpha that are compared with the respective BCS predictions. Mechanisms such as gap anisotropy and strong coupling that can cause deviations of the thermodynamics from the BCS predictions, especially the heat capacity jump at T-c, are considered. Extensions of the alpha-model that have appeared in the literature, such as the two-band model, are also discussed. Tables of values of Delta(T)/Delta(0), the normalized London parameter Lambda(T)/Lambda(0) and lambda(L)(T)/lambda(L)(0) calculated from the BCS theory using alpha = alpha(BCS) are provided, which are the same in the alpha-model by assumption. Tables of values of the entropy, heat capacity and thermodynamic critical field versus T for seven values of alpha, including alpha(BCS), are also presented.

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Title: Project of the new multifunctional reflectometer GRAINS with horizontal sample plane at the IBR-2M pulsed reactor in Dubna

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Vorobiev A, 2004, PHYS REV LETT, V93, DOI 10.1103/PhysRevLett.93.267203
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Abstract: The new multifunctional reflectometer GRAINS is under construction at the modernized high flux IBR-2 pulsed reactor (IBR-2M) of the FLNP JINR (Dubna, Russia). The principal feature of this reflectometer, the horizontal sample plane (or vertical scattering plane), enables the study of liquid-containing interfaces. The reflectometer will operate in the time-of-flight regime with constant sample illumination during measurements. The important advantage is the constant angular resolution with unvaried background. The additional modes of the GRAINS reflectometer comprise (1) off-specular scattering and GISANS, which are measured simultaneously in the TOF regime at a 2D position-sensitive detector; (2) angular encoding in the horizontal plane, which is provided by a Larmor precession region limited by current sheets in front of the sample; (3) 3D polarimetry in reflection, which is provided by a Larmor precession region around the sample position. The design of the reflectometer is optimised to take better advantage of an exceptionally broad wavelength band of the new cold moderator at the IBR-2M. The set-up will open up principally new possibilities for investigations in the field of interface nano-science at the IBR-2M reactor.
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Abstract: We revisit the Aslamazov-Larkin theory of paraconductivity in two dimensions to identify its universal and its specific model-dependent features. We show that both the numerical prefactor and the temperature dependence of the experimental paraconductivity in underdoped La2-xSrxCuO4 provide evidence that the paired carriers behave as if they were nearly free fermionic quasiparticles. This conclusion is strengthened by the analysis of paraconductivity data in the presence of a finite magnetic field. In this case we show that there exists a temperature range above T-c where the superconducting fluctuations are purely Gaussian and their destruction is determined by a rather low magnetic field scale H-c2(G)(T=0).
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Author(s): Weyeneth, S (Weyeneth, S.); Schneider, T (Schneider, T.); Zhigadlo, ND (Zhigadlo, N.

D.); Karpinski, J (Karpinski, J.); Keller, H (Keller, H.)
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Schneider T, 1998, EUR PHYS J B, V3, P413, DOI 10.1007/s100510050329
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Cited Reference Count: 39
Abstract: We report and analyze reversible magnetization measurements on a high quality MgB(2) single crystal in the vicinity of the zero-field transition temperature, T(c) similar or equal to 38.83 K, at several magnetic fields up to 300 Oe, applied along the c-axis. Although MgB(2) is a two-gap superconductor our scaling analysis uncovers remarkable consistency with 3D-xy critical behavior, revealing that close to criticality the order parameter is a single complex scalar as in (4)He. This opens up the window onto the exploration of the magnetic field induced finite size effect, whereupon the

correlation length transverse to the applied magnetic field Hi applied along the i- axis cannot grow beyond the limiting magnetic length L(Hi) = (Phi(0)/(aH(i)))(1/2) with a similar or equal to 3.12, related to the average distance between vortex lines. We find unambiguous evidence for this finite size effect. It implies that in type II superconductors, such as MgB(2), there is a 3D-1D crossover line H(pi)(T) = (Phi(0)/(a xi(-)(j0)xi(-)(k0)))(1 - T/T(c))(4/3) with i not equal j not equal k and xi(+/-)(io,j0,k0) denotes the critical amplitudes of the correlation lengths above (+) and below (-) T(c) along the respective axis. Consequently, above H(pi)(T) and T < T(c) superconductivity is confined to cylinders with diameter L(Hi) (1D). In contrast, above T(c) and H(pi)(T) = (Phi(0)/(a xi(+)(j0)xi(+)(k0)))(T/T(c) - 1)(4/3) the uncondensed pairs are confined to cylinders. Accordingly, there is no continuous phase transition in the (H, T)- plane along the H(c2)-lines as predicted by the mean-field treatment.

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Abstract: For layered superconductors, we study the specific nonlinear Josephson plasma waves (NJPWs) propagating along thin superconducting slabs and damping away from them. Two cases are considered, when the superconductor is surrounded by either vacuum or metals. The magnetic field of the NJPW is distributed symmetrically with respect to the middle of the sample and can change its sign inside the slab. The impedance ratio of the tangential electric and magnetic field amplitudes for NJPWs can be of the order of unity. For the case of a superconductor surrounded by the vacuum, this results in a non-monotonic dispersion relation, omega(k), strongly sensitive to the NJPW amplitudes. Therefore, the "stopping light" phenomenon can be observed at frequencies where d omega(k)/dk = 0. Resonance excitations of the NJPWs should produce anomalies in the amplitude dependence of the reflectivity and transmissivity of the incident THz waves, which could be useful for THz devices. Animations illustrating the results presented here, are available online at dmi.riken.go.jp/nonlinear. (c) 2008 Elsevier B.V. All rights reserved.

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ZIMAN JM, 1960, ELECTRON PHONONS, P257

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Abstract: High quality samples and absence of superconductivity down to 40 mK make of ZrB2 the best normal state reference system for the superconducting isostructural MgB2. Actually, the question of pairing has to be focused on the electron-phonon interaction in the normal state. After presenting the resistivity measurements of ZrB2, we explain the details of the Bloch-Gruneisen and Einstein models used to deduce the first results. We then compare experimental de Haas-van Alphen effect data with theoretical Fermi surfaces to present additional results on electron quasi-particle renormalization. The estimations reveal an isotropic and negligible coupling constant of in average [lambda(tr)] = 0.145. The contribution of the coupling to the optical phonon modes is 0.082, in contrast to the known larger coupling of 0.283 [3] to the E-2g phonon mode in MgB2.

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Abstract: Measurements of higher harmonics of the ac voltage response in YBCO thin film strips under low amplitude and low frequency harmonic excitation, as a function of temperature, show a non linear response of the conductivity in the superconducting transition interval. The third and fifth harmonics of the local voltage as a function of T exhibit a peak near T(c) and their amplitudes seem to be closely related to the T-derivative of the first harmonic. The peaks are linearly dependent on the current amplitude and do not depend on frequency. The observed data are partially interpreted in terms of ac current induced thermal modulation of the sample temperature added to strong thermally activated fluctuations in the transition region. The fit of the model to the data gives information of some sample properties such as zero temperature critical current, zero onset resistance and thermal boundary conductance.

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Abstract: The fluctuation-induced diamagnetism (FD) above the transition temperature T, is studied through the isothermal field-dependence of the diamagnetic magnetization M(d iota a). While for T approximate to T(c) and H -> 0 one has-M(d iota a) proportional to (H)(1/2),on increasing field an upturn occurs and vertical bar M(dia)vertical bar begins to decrease, in correspondence to field-induced quenching of the fluctuating pairs. For BCS superconductors (SC) as MgB(2) the upturn field H(up) is in the range 100-800 Oe, while in optimally doped high-temperature SC(HT(c)SC) Hup is expected in the range of several Tesla, because of the small coherence length. At variance, in non-homogeneous HT(c)SC (under- or overdoped) or in the presence of impurities causing diffuse transition, strong increase Of M(d iota a) and Hup reduced by order of magnitudes are observed. The reasons of these behaviors are discussed in the report. In particular the difference between the FD in heterogeneous HT(c)SC (related to SF) and the precursor diamagnetism for diffuse transitions such as in Al-doped MgB(2) (unrelated to SF) is emphasized and it is shown how the temperature dependence of H(up) discriminates between the two effects.

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Title: Microwave fluctuational conductivity in YBa2Cu3O7-delta

Author(s): Silva, E (Silva, E); Marcon, R (Marcon, R); Sarti, S (Sarti, S); Fastampa, R (Fastampa, R); Giura, M (Giura, M); Boffa, M (Boffa, M); Cucolo, AM (Cucolo, AM)

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Abstract: We present measurements of the microwave complex conductivity at 23.9 and 48.2 GHz in YBa2Cu3O7-delta films, in the fluctuational region above T-c. With increasing temperature, the fluctuational excess conductivity drops much faster than the well-known calculations within the time-dependent Ginzburg-Landau theory [H. Schmidt, Z. Phys. 216, 336 (1968)]. Approaching the transition temperature, slowing down of the fluctuations is observed. We discuss the results in terms of a modified Gaussian theory for finite-frequency fluctuational conductivity, where renormalization is introduced in order to account for the T --> T-c regime, and a spectral cutoff is inserted in order to discard high-momentum modes. The data are in excellent agreement with the modified theory, when formulated for three-dimensional, anisotropic superconductors, in the whole experimentally accessible temperature range, and for both frequencies.

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Author(s): Losev, A (Losev, A)
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Yuan HQ, 2000, PHYS REV B, V62, P15569, DOI 10.1103/PhysRevB.62.15569
Cited Reference Count: 26
Abstract: The convolution method for the calculation of local densities of states is presented more

thoroughly along with its expression in terms of Green functions, This constructive approach allows us to produce results for a higher dimensionality from lower-dimensional parts. Its applications and different aspects are discussed for some simple cases.

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Title: The effect of superstructural ordering on the properties of high-temperature oxide superconductor systems

Author(s): Anshukova, NV (Anshukova, NV); Golovashkin, AI (Golovashkin, AI); Ivanova, LI (Ivanova, LI); Rusakov, AP (Rusakov, AP)

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Abstract: The effect of superstructural ordering in the oxygen sublattice (in addition to the influence of the antiferromagnetic interaction of copper ions) on the electron and phonon characteristics of oxide high-temperature superconductor (HTSC) systems has been studied. Taking into account this ordering effect, it is possible to explain a wide range of experimental data, including doping-induced changes in shape of the Fermi surface, features of the phonon spectra, the existence of stripes, the presence of a pseudogap and its coexistence with the superconducting gap, and some peculiarities in the phase diagrams of HTSCs. (C) 2003 MAIK "Nauka/Interperiodica".

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Windt M, 1999, APPL PHYS LETT, V74, P1027, DOI 10.1063/1.123444
Cited Reference Count: 26
Abstract: Using the Bethe-Salpeter equation including high electric fields, the dependence of the critical temperature of onsetting superconductivity on the applied field is calculated analytically. The critical temperature of pairing is shown to increase with the applied field strength. This is a new field effect and could contribute to the explanation of recent experiments on field-induced superconductivity. From the field dependence of the Bethe-Salpeter equation, the two-particle bound-state solution is obtained as a resonance with a tunneling probability analogous to the WKB solution of a single particle confined in a potential and coupled to an electrical field.
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Title: Plasma modes in superconducting wires: Optimized experimental configuration

Author(s): Camarota, B (Camarota, B); Parage, F (Parage, F); Wooldridge, I (Wooldridge, I); Delsing, P (Delsing, P); Buisson, O (Buisson, O)

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Abstract: An experimental configuration is analyzed in order to Study plasma modes in a superconducting wire deposited onto SrTiO3. A dispersion relation has been derived by evaluating the effect of the environment surrounding the wire. It corresponds to the one-dimensional dispersion law predicted for an isolated superconducting wire. Preliminary measurements are presented. They show 1D plasma modes in the optimized experimental configuration here studied.

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Author(s): Doria, MM (Doria, MM); d'Almeida, FMR (d'Almeida, FMR); Buisson, O (Buisson, O)
Source: PHYSICAL REVIEW B **Volume:** 57 **Issue:** 9 **Pages:** 5489-5495 **DOI:** 10.1103/PhysRevB.57.5489 **Published:** MAR 1 1998
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Abstract: A plasma wave propagates inside an anisotropic superconducting film sandwiched between two semi-infinite nonconducting bounding dielectric media. In the presence of a c-axis-parallel magnetic field, perpendicularly applied to the film surfaces, we show how vortices, known to cause dissipation and change the penetration depth, affect the propagative mode. We obtain the complex wave number of this mode and, using YBa2Cu3O7-x at 4 K as an example, determine a region where the vortex contribution is dominant and dissipation is small.

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Author(s): Artemenko, SN (Artemenko, SN); Kobelkov, AG (Kobelkov, AG)

Source: JETP LETTERS **Volume:** 65 **Issue:** 4 **Pages:** 331-336 **DOI:** 10.1134/1.567375 **Published:** FEB 25 1997

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Cited Reference Count: 18
Abstract: Simple expressions are obtained for the current and charge densities in layered superconductors with d pairing. The conductivities describing the response to solenoidal and potential electric fields are determined by the momentum relaxation time and the imbalance time of the populations of the blanches of the quasiparticle spectrum and exhibit a different frequency dependence. The collective modes associated with the oscillations of the potential electric field are investigated. (C) 1997 American Institute of Physics.
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Title: Direct measurement of the Bernoulli effect in superconductors
Author(s): Chiang, YN (Chiang, YN); Shevchenko, OG (Shevchenko, OG)
Source: FIZIKA NIZKIKH TEMPERATUR **Volume:** 22 **Issue:** 6 **Pages:** 669-671 **Published:** JUN 1996
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TSZYAN YN, 1986, FIZ NIZK TEMP, V12, P816
Cited Reference Count: 9
Abstract: A method of measuring the Bernoulli potential in superconductors when the electron velocity approaches the critical one is suggested. The maximum value of the Bernoulli potential in a type-I superconductor (Ta) is measured. The magnitude obtained indicates that the effective mass of an electron in the Cooper pair is consistent with that of a free one.
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Record 93 of 149
Title: Penetration of the magnetic field into the twinning plane in type-I and -II superconductors
Author(s): Mironov, SV (Mironov, S. V.); Buzdin, A (Buzdin, A.)
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Abstract: It is demonstrated that in the type-I and -II superconductors with weakly transparent twinning planes (TP) the penetration of the external parallel magnetic field into the region of the twinning plane can be energetically favorable. In the type-I superconductors the twinning planes become similar to Josephson junctions and the parallel magnetic field penetrates into the TP in the form of Josephson-like vortices. This leads to an increase in the critical magnetic field values. The corresponding phase diagram in the parameter plane "temperature-magnetic field" essentially differs from the one obtained without taking the finite value of the magnetic field near the TP into account. A comparison between the obtained phase diagrams and experimental data for different type-I superconductors can allow to estimate the value of the TP transparency, which is the only fitting parameter in our theory.

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Record 94 of 149

Title: Non-ohmic Electrical Transport Properties Above the Critical Temperature in Optimally and Underdoped Superconducting YBa2Cu3O6+x

Author(s): Lang, W (Lang, W.); Puica, I (Puica, I.); Zechner, G (Zechner, G.); Kitzler, T (Kitzler, T.); Bodea, MA (Bodea, M. A.); Siraj, K (Siraj, K.); Pedarnig, JD (Pedarnig, J. D.)

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Abstract: The resistivity and the Hall effect as a function of current density and temperature in the normal state of very thin films of YBa2Cu3O6+x are measured with a fast pulsed-current technique. The in-plane longitudinal and transverse (Hall) conductivities are reduced in intense current densities up to several . In optimally-doped samples, this non-ohmic effect is limited to temperatures below 100 K. In a moderately underdoped sample, however, the non-linearity extends to the temperature range from T (c) =53 K to similar to 150 K. The non-linear part of the Hall conductivity does not scale with a critical exponent, thus excluding classical amplitude fluctuations of the superconducting order parameter as possible origin.

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Author Keywords: Cuprate superconductors; YBa2Cu3O6+x; Non-ohmic behavior; Pseudogap

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Title: Mean-field calculations on the magnetic properties of the two-gap superconductor Lu2Fe3Si5

Author(s): Huang, H (Huang, Hai); Liu, MX (Liu, Minxia)

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Abstract: Based on Ginzburg-Landau theory, we study the temperature dependence of upper critical field and London penetration depth for the superconducting crystal Lu2Fe3Si5. All the results fit the experimental data well. We also indicate that the larger gap opens in the quasi-one-dimensional part of Fermi surfaces. (C) 2010 Elsevier B.V. All rights reserved.
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Author(s): Kaplan, IG (Kaplan, Ilya G.); Soullard, J (Soullard, Jacques)
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Zhitomirsky ME, 2001, PHYS REV LETT, V87, DOI 10.1103/PhysRevLett.87.057001

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Abstract: After a short account of the present state in the superconductivity (SC), the non-copper perovskite ruthenate, Sr(2)RuO(4), superconductor is discussed, This superconductor possesses unconventional spin-triplet symmetry of Cooper's pairs and has been a subject of intense researches. It was revealed that the substitution of Ru atoms by small amount of non-magnetic Ti atoms leads to creation of magnetic order and destruction of superconductivity. Comparative study of the electronic structure of pure and Ti-doped Sr(2)RuO(4) was performed by the developed by our group embedded cluster method at the Hartree-Fock and MP2 electron correlation level. The representative cluster was embedded into the Madelung potential that mimic a real crystal. Accounting of interatomic interaction in our calculations leads, in contrast with the tight-binding model usually applied for study Sr(2)RuO(4), to the large electron transfer from 0 to Ru. Already at the HF level the ionic model failed. At the MP2 level, the electron correlation considerably increases the electron transfer making the values of charges on atoms far enough from the charges in the formal ionic model. Calculation at the DFT level gives the similar results. The Ti substitution induces the essential charge redistribution between d-orbitals of Ru. A drastic effect of the Ti impurity on the spin density distribution was revealed. In the Ti-substituted crystals, the local spin density near impurity disappears on Sr and localizes on Ru and four O atoms surrounding it. The NBO analysis shows that the spin density in doped crystals is localized on orbitals directed along z axis. These results are in complete agreement with experiments.

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Author(s): Kaplan, IG (Kaplan, Ilya G.); Soullard, J (Soullard, Jacques)

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Zhitomirsky ME, 2001, PHYS REV LETT, V87, DOI 10.1103/PhysRevLett.87.057001
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Abstract: Electronic structure of the pure and Ti-doped Sr(2)RuO(4) superconductor is studied by the embedded cluster method at the Hartree-Fock (HF) and the second-order Moller-Plesset perturbation theory (MP2) electron correlation levels. The representative cluster was embedded into the Madelung potential that mimics a real crystal. The interatomic interaction leads to an effective electron transfer from O to Ru at both the HF and MP2 levels. At the MP2 level, we obtained the Ru charge equal to +1.57, instead of +4 in the formal valence (ionic) model. The e(g) level, which was assumed empty in most of the previous studies, was found partly populated. The Ti substitution almost does not change the atomic charges, but induces the essential charge redistribution between d orbitals of Ru that leads to an increase of the e(g) population. A drastic effect of the Ti impurity on the spin density distribution was revealed; it strongly depends on the electron correlation. In undoped crystals, the MP2 spin density is located only on the Ru and Sr atoms. In the Ti-substituted crystals, the local spin density near an impurity disappears on Sr and localizes on Ru and four O atoms, surrounding it, on orbitals directed along the z axis. The latter are in complete agreement with experiments by Maeno and co-workers.
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Author(s): Gubin, AI (Gubin, A. I.); Cherpak, NT (Cherpak, N. T.); Lavrinovich, AA (Lavrinovich, A. A.); Oganisian, KV (Oganisian, K. V.)
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Cherpak NT, 2006, LOW TEMP PHYS+, V32, P608, DOI 10.1063/1.2215377
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Abstract: The results of an experimental study of the fluctuation conductivity of an optimally doped YBa2Cu3O7-delta epitaxial film are presented. The results were obtained from measurements of the complex reflection coefficient of the sample at grazing incidence according to a method developed and implemented by the authors in the millimeter wavelength range. The results demonstrate good agreement with a theoretical model constructed in the framework of Gaussian theory for a frequency-limited fluctuational 2D microwave conductivity in the temperature interval 93-120 K. (c) 2007 American Institute of Physics.

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Abstract: We propose a superconductivity theory of two-band nonadiabatic systems with strong electron correlations in the linear approximation in nonadiabaticity. Assuming a weak electron-phonon interaction, we obtain analytic expressions for the vertex and "intersecting" functions for each of the two bands. With the diagrams involving intersections of two electron-phonon interaction lines taken into account (which means going beyond the Migdal theorem), we determine mass operators of the Green's functions and use them to derive the basic equations of the superconductivity theory for two-band systems. We find an analytic expression for the superconducting transition temperature T. that differs from the expression in the case of the standard two-band systems by an essential renormalization of the relevant quantities that results from the nonadiabaticity effects and strong electron correlations. We study the dependence of T-c and of the isotopic coefficient a on the Migdal parameter m = omega(0)/epsilon(F) and show that accounting for the overlap of energy bands on the Fermi surface and for the nonadiabaticity effects at small values of the transferred momentum (q << 2p(F)) allows obtaining high values of T-c even for the weak electron-phonon interaction.

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