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NOTA BENE:

Dear Subscribers: **As you know, *High-T_c Update* will cease publication sometime within the next few months. (The date of the last issue will depend mainly on our staffing situation. We will let you know as soon as a decision is made.) Here are a few information resources that may be helpful to you in our absence:**

Condensed Matter e-print archive (cond-mat) at Los Alamos National Laboratory http://xxx.lanl.gov/list/cond-mat.supr-con/recent and related links.

Electrotechnical Laboratory (ETL) Superconductivity Papers Database http://www.aist.go.jp/RIODB/sprcnd_etl/.

We will, in the next few weeks, try to find a few more resources that can help our readers. If any of you know of a Web site or resource that *HTCU* readers may find useful, please let us know and we will print it in the newsletter.

Vortices

The upper and lower critical points in untwinned $YBa_2Cu_3O_{7-\delta}$ single crystals with dilute columnar defects have been investigated by W. K. Kwok (Argonne) et al. Dilute columnar defects were found to raise the upper critical point, indicating that the transition near the upper critical point is a vortex-entanglement transition. The lower critical point was found to be very sensitive to columnar-defect disorder, and its position can be described by a Lindemann-like criterion similar to that used for melting. The authors found that dilute columnar defects induce nonlinear behavior in the I-V curves of the vortex-liquid state above the lower critical point, which is interpreted as a vestige of the critical region associated with the Bose-glass transition below the lower critical point.

A related paper by G. W. Crabtree (Argonne) et al. reports the differing effects of line and point disorder upon the upper and lower critical points in the (H-T) vortex phase diagram of $YBa_2Cu_3O_{7-\delta}$. The authors found that dilute line disorder induces a Bose-glass transition at low fields, which is replaced at the lower critical point by first-order melting at higher fields. The upper critical point is lowered by point disorder but raised by line disorder.

Using an ac technique, M. Konczykowski (Ecole Polytechnique) et al. have investigated the first-order phase transition in the vortex lattice in $Bi_2Sr_2CaCu_2O_{8+\delta}$ *(Bi-2212)* by independently varying the dc magnetic field perpendicular ($H_\perp$) and parallel ($H_{||}$) to the layers. The authors thus independently controlled the density of 2D pancake and Josephson vortices. The authors found at least two distinct regions in the vortex-solid phase, and they show corresponding phase diagrams in the $H_\perp$-$H_{||}$ plane at different temperatures.

A preprint by C. Reichhardt (UC-Davis) et al. points out several recent experimental and numerical observations that are at odds with the vortex-glass theory of the freezing of disordered vortex matter. To investigate this issue, the authors performed numerical simulations of the overdamped London-Langevin model and used finite-size scaling to analyze their results. The authors found that upon approaching the transition, the initial vortex-glass criticality is arrested at a crossover temperature. Below this temperature, the time scales continue to grow rapidly, consistent with the Vogel-Fulcher form, while the spatial correlation length ξ stops exhibiting any observable divergence. The authors call this mode of freezing the vortex-molasses scenario.

Two preprints by C. J. van der Beek (Ecole Polytechnique) et al. report time-resolved local induction measurements near the vortex-lattice order-disorder transition in optimally doped $Bi_2Sr_2CaCu_2O_{8+\delta}$ *(Bi-2212)* crystals. The results show that the high-field disordered phase can be quenched to fields as low as half the transition field. The authors interpret the results in terms of supercooling of the high-field phase and the possible first-order nature of the order-disorder transition at the second magnetization peak.

Using numerical simulations, C. J. Olson and C. Reichhardt (UC-Davis) have investigated the transverse depinning of moving vortex lattices interacting with random disorder. When the vortex lattice is defect-free and moving in correlated one-dimensional channels under the influence of a high longitudinal drive, a finite transverse depinning barrier for vortex lattices is observed. However, when the longitudinal drive is decreased and defects appear in the vortex lattice, the barrier is found to disappear in the plastic-flow regime. The authors found that at the transverse depinning transition, the vortex lattice moves in a staircase pattern with a clear transverse narrow-band voltage-noise signature.

A preprint by M. C. Marchetti et al. (Syracuse) reports an investigation of the mean-field dynamics of an overdamped viscoelastic medium driven through quenched disorder. The authors' model incorporates coexistence of pinned and sliding degrees of freedom and can exhibit continuous elastic depinning or first-order hysteretic depinning. Numerical simulations show mean-field instabilities corresponding to stick-slip events, leading to premature switching. The model is relevant for the dynamics of driven vortex arrays in superconductors and other extended disordered systems.

A preprint by C. Reichhardt (UC-Davis) et al. reports numerical simulations of the motion of vortex lattices that are interacting with periodic pinning arrays and are driven by both ac and dc currents. The vortex flow was found to occur by the motion of interstitial vortices through the periodic potential generated by the vortices that remain pinned at the pinning sites. Shapiro steps were observed, and the widths of the phase-locked current steps as a function of the ac drive were found to follow a Bessel function, in agreement with theory.

The temperature and field dependence of the effective penetration depth λ_{eff} in the vortex state of a d-wave superconductor, as measured by muon-spin-rotation (μSR) experiments, has been calculated by M.H.S. Amin (Simon Fraser) et al. using a nonlocal London model. The authors show that at temperatures below $T^* \propto \sqrt{B}$, the linear T dependence of λ_{eff}^{-2} crosses over to a T^3 dependence. This could provide an explanation for the low-temperature flattening of the λ_{eff}^{-2} curve observed in a recent μSR experiment by J. E. Sonier et al. [Phys. Rev. Lett. **83**, 4156 (1999)].

Using a d-wave gap model, E. Schachinger (Graz) and J. P. Carbotte (McMaster) have shown that the vortex-state thermal and transport properties of the high-T_c copper oxides are dominated by the extended quasiparticle states that exist along the nodal directions in momentum space. The authors find that the Doppler shift on these states due to the supercurrents circulating around the vortex cores introduces new Van Hove ridges into the energy-dependent local density of states as a function of distance in the regions between cores. The authors also examined the effect of impurities upon the topology of the Van Hove ridges in both the Born and unitary-scattering limits.

Using the Ginzburg-Landau equations, S. V. Yampolskii and F. M. Peeters (Antwerpen) have investigated the vortex state in thin ($d \ll \xi, \lambda$) and small ($R \sim \xi$) mesoscopic disks in fields above H_{c2} where surface superconductivity occurs. The authors found both multivortex states and the giant vortex state.

Thin stacks consisting of a single intrinsic Josephson junction on *$(Bi,Pb)_2Sr_2Ca_2Cu_3O_{10+\delta}$ [(Bi,Pb)-2223]* thin films under the influence of external microwave fields have been investigated by Ch. Helm (Los Alamos and Regensburg) et al. The I-V characteristics showed a single resistive branch, a clear superconducting gap edge structure, and a pronounced current step in external microwave fields. Using numerical simulations including an ac magnetic field parallel to the layers, the authors found that the experimental features of the structure can be explained by a collective motion of Josephson vortices.

The microwave response of the organic superconductor *κ-$(BEDT\text{-}TTF)_2Cu(NCS)_2$* has been studied by M. M. Mola (Montana State) et al. using a cavity perturbation technique. The authors observed a Josephson plasma resonance below T_c (~10 K) and thus were able to investigate the vortex structure in the mixed state of this highly anisotropic type-II superconductor. In frequency studies over the range 28-153 GHz, the authors found that the weak-pinning theory of L. N. Bulaevskii et al. [Phys. Rev. Lett. **74**, 801 (1995)] most consistently describes their results.

Theory

A preprint by D. Tanaskovic et al. (Belgrade) presents a derivation of the Ginzburg-Landau equations from the microscopic theory for clean, layered superconductors with $d_{x^2-y^2}$ pairing symmetry, including the effect of Pauli paramagnetism. The authors calculate the upper critical field H_{c2} parallel to the c axis, the reversible magnetization M in high magnetic fields, and the high-temperature spin susceptibility. The authors find good agreement with experiment.

The spectral signatures of dimensional crossover in the continuum theory of a quasi-one-dimensional superconductor have been examined in a paper by E. W. Carlson (UCLA) et al. The authors compare their results with a number of experiments in the high-temperature superconductors, which are regarded as electronically quasi-one-dimensional on a local scale.

A model of superconductivity in the layered high-temperature superconducting cuprates is proposed in a preprint by A. A. Abrikosov (Argonne). The model is based on extended saddle-point singularities in the electron spectrum, weak screening of the Coulomb interaction, and phonon-mediated interaction between electrons, plus a small short-range repulsion of spin-fluctuation origin. The author uses the model to explain (a) the large values of T_c, (b) the isotope effect with oxygen and copper, (c) the existence of two types of order parameter, (d) the inelastic neutron-scattering peak, and (e) the positive curvature of the upper critical field as a function of temperature.

In a recent paper, E. Schachinger (Graz) and J. P. Carbotte (McMaster) showed that there exists a signature of the 41 meV neutron spin resonance in the optical data of optimally doped $YBa_2Cu_3O_{6.95}$ *(YBCO)* and that an absolute estimate of its coupling to the charge carriers can be made. In a new preprint, these authors extend their analysis to $Tl_2Ba_2CuO_{6+\delta}$ *(Tl-2201)* with a T_c = 90 K. The authors find the spin resonance to be much broader than in *YBCO* and $Bi_2Sr_2CaCu_2O_{8+\delta}$ *(Bi-2212),* although no neutron data exist as yet. The authors give a detailed analysis of the superconductivity of *Tl-2201,* in which the interactions responsible for superconductivity are constructed solely from consideration of optical data.

A preprint by G. G. Sergeeva (Kharkov) presents a scenario for the superconducting transition in quasi-two-dimensional superconductors. In this picture, the interaction of fluctuating spin waves with holes in the CuO_2 planes leads to the pairing of holes, generates superconducting regions at T_{c0}, and produces a temperature dependence in the interlayer coupling strength $t_c(T)$. When $t_c(T)$ is small, the transition of the sample to a coherent superconducting state occurs at $T_c < T_{c0}$.

A detailed tight-binding analysis of the electron band structure of the CuO_2 plane of layered cuprates has been performed by T. Mishonov and E. Penev (Leuven) using a σ-band Hamiltonian with four orbitals: *Cu* $3d_{x^2-y^2}$, *Cu* 4s, *O* $2p_x$, and *O* $2p_y$. The authors used their results to fit the Fermi surface of $Nd_{2-x}Ce_xCuO_4$ and $Bi_{1.73}Pb_{0.42}Sr_{1.94}Ca_{1.3}Cu_{1.92}O_{8+\delta}$ measured in angle-resolved photoemission (ARPES) and angle-resolved ultraviolet spectroscopy (ARUPS) experiments. The authors also applied a similar approach to the RuO_2 plane of Sr_2RuO_4.

A theoretical extension of the Brinkman-Rice picture to explain the metal - Mott-insulator transition is described in two preprints by H.-T. Kim (ETRI). For strongly correlated metals, including the high-temperature superconductors, the effective mass of a quasiparticle is found to obey $m^*/m = 1/(1 - \kappa^2\rho^2)$, where κ is the correlation strength of the on-site Coulomb repulsion U and ρ is the band-filling factor. Comparison with experimental data suggests that κ = 1. The author also asserts that the extended Brinkman-Rice picture is better able to explain the Mott transition than Hubbard models.

Using an extended Hubbard model, J.-X. Zhu (TCSUH) et al. have calculated both the local (i.e., single-site) and spatially averaged differential tunneling conductance in d-wave superconductors containing nonmagnetic impurities in the unitary limit. The authors find that a random distribution of unitary impurities of any concentration can at most give rise to a finite zero-bias conductance (with no peak there) in spatially averaged non-STM tunneling. On the other hand, local tunneling in the immediate vicinity of an isolated impurity shows a conductance peak at zero bias. The authors also propose a theoretical model that explains the spatial structure in the STM tunneling conductance above a single *Zn* impurity in *Bi-2212* recently observed by S. H. Pan et al. [see Oct. 15, 1999, High-T_c Update].

A phase diagram of temperature vs exchange field has been obtained by J.-X. Zhu (TCSUH) et al. using a BCS model for d-wave superconductivity in CuO_2 layers coupled to ferromagnetic RuO_2 layers in $RuSr_2GdCu_2O_8$ *(Ru-1212).* The authors found that the Fulde-Ferrell-Larkin-Ovchinnikov state is very sensitive to the band-filling factor. For strong exchange field, the authors find that superconductivity can exist only in the interfaces between ferromagnetic domains. The authors calculate the magnetization curve and compare with experimental results. The authors also propose an experiment by scanning tunneling spectroscopy (STS) near a single unitary impurity to detect the strength of the exchange interaction.

A preprint by N. E. Mavromatos and S. Sarkar (King's College London) discusses nodal liquids in the context of extended t-J models. The authors use the spin-charge separation ansatz as applied to the nodes of a d-wave superconducting gap. The authors point out the possibility of the existence of certain points in the parameter space of the model characterized by dynamical supersymmetries between the spinon and holon degrees of freedom, which are quite different from the symmetries in conventional supersymmetric t-J models.

A comprehensive study of doped RVB (resonating valence bond) states has been performed by M. Havilio and A. Auerbach (Technion). The authors found a fundamental connection between superconductivity and quantum spin fluctuations in underdoped cuprates: Cooper pair hopping strongly reduces the local magnetization m_0. The authors stress that this effect pertains to recent muon-spin-rotation experiments in which m_0 varies weakly with hole doping in the poorly conducting regime but drops precipitously above the onset of superconductivity.

As reported in a preprint by Y. Yuzhelevski et al. (Ben Gurion University of the Negev), a new procedure for the analysis of random telegraph signals in the time domain has been developed and applied to the analysis of voltage fluctuations in the current-induced dissipative state in superconducting thin films. The procedure, based entirely on the difference in the statistical properties of discrete Marcovian telegraph fluctuations and Gaussian background noise, ascribes each point of the experimental time record to one of the telegraph states.

The development of a microscopic theory for the coupling of intrinsic Josephson oscillations and dispersive phonon branches in layered superconductors has been developed by Ch. Preis (Regensburg) et al. The effect of phonons on the electronic c-axis transport enters through an effective longitudinal dielectric function. This coupling provides an explanation of recently observed subgap resonances in the I-V curves of anisotropic cuprate superconductors forming a stack of short Josephson junctions.

The mutual inductance of an infinite superconducting slab in the Meissner state probed by either point-dipole or circular-current-loop applied magnetic fields has been examined by M. W. Coffey (Colorado). The author accounts for the effect of a distinct, constant permeability of the slab and obtains expressions for the full mutual inductance and various approximations. The author also presents closed-form representations for an inductance per length factor, which has proven useful in inductance data inversion in order to obtain an absolute measurement of the London penetration depth.

$RBa_2Cu_3O_{7-\delta}$

The Wiedemann-Franz ratio compares the thermal and electrical conductivities in a metal. Y. Zhang (Princeton) et al. describe a new way to determine its value, based on the thermal Hall conductivity, and they apply this technique to copper and untwinned $YBa_2Cu_3O_{7-\delta}$. In the latter, the authors uncover a T-linear dependence and a suppression of the Hall-channel Wiedemann-Franz ratio.

In a preprint by S. W. Lovesey (Rutherford Appleton Laboratory) and U. Staub (PSI Villigen), the authors argue that the linewidth of the spectrum of neutrons scattered by Tb^{3+} in $YBa_2Cu_3O_{7-\delta}$ is created by the modulation of the crystal-field potential by lattice vibrations. The expression for the linewidth (also called the relaxation rate) contains an intermediate crystal-field state. The authors' model contains three states, the two probed in the scattering experiment and a third which is the agent for the principal relaxation mechanism. The authors also have used this model to successfully interpret inelastic neutron-scattering results for the relaxation of Ho^{3+} and Tm^{3+} in cuprates, adding support to the idea that the relaxation rate is dominated by the magneto-elastic interaction.

As reported by K. Grube (Karlsruhe) et al., the linear compressibilities and the thermal expansion of an untwinned nearly optimally doped $YBa_2Cu_3O_{6.94}$ single crystal have been measured along the three crystallographic axes with a high-resolution dilatometer mounted in a high-pressure cell. The measurements were performed over a temperature range of 50-320 K under hydrostatic gas pressure up to 0.65 GPa. At 300 K, the measured bulk modulus is reduced and shows a strong enhancement under increasing pressure due to pressure-induced oxygen ordering. At lower temperatures, when oxygen ordering is frozen, the bulk modulus is increased and shows a significantly reduced enhancement under pressure. This pressure dependence, however, is still anomalously high, probably due to bonds of extremely different compressibilities within the unit cell. The wide spread of values of the bulk modulus reported in the literature can be explained by this strong pressure dependence.

The lattice parameters and T_c of $Y_{1-y}Ca_yBa_2Cu_3O_{7-\delta}$ under pressure up to 10 GPa have been determined by W. H. Fietz et al. (Karlsruhe) using a diamond anvil cell. By modifying the extended charge-transfer model to account for pressure-induced changes of the compressibilities, the authors found that the calculated T_c(P) values were in excellent agreement with the experimentally determined values.

A preprint by C.-J. Kim (KAERI) et al. reports that the growth mode of $YBa_2Cu_3O_{7-\delta}$ *(YBCO)* grains at the top surface of top-seeded melt-growth-processed *YBCO* superconductors depends strongly upon the thickness of the $Sm_{1.8}Ba_{2.4}Cu_{3.4}O_{7-\delta}$ *(SBCO)* seeds. Thin slab-like *SBCO* seeds led to the nucleation of undesirable subsidiary *YBCO* grains in the seeded area, while such subsidiary nucleation was hardly observed when thick seeds were used. A related paper by C.-J. Kim (KAERI) et al. reports on the properties of *YBCO* superconductors fabricated using several *SBCO* seeds on the top surface to shorten the processing time. However, the authors found that the levitation force and trapped magnetic fields of the samples decreased as the number of seeds increased.

The effects of chemical doping and hydrostatic pressure on T_c of $YBa_2Cu_3O_x$ *(Y-123)*, $Y_{0.89}Ca_{0.11}Ba_2Cu_3O_x$ *[(Y,Ca)-123]*, and $NdBa_2Cu_3O_x$ *(Nd-123)* single crystals with various oxygen contents x have been studied by S. I. Schlachter et al. (Karlsruhe). In the underdoped region, all these compounds showed a peak in dT_c/dP at the same $n_h \approx 0.11$. The authors suggest that the origin of this peak is a strong influence of lattice deformations on the electronic structure.

Other Cuprates

The oxygen isotope effect on the relaxation rate of crystal-field excitations in the slightly underdoped high-temperature superconductor $HoBa_2Cu_4O_8$ has been investigated by D. Rubio Temprano (ETH Zürich and PSI Villigen) et al. using inelastic neutron scattering. For the ^{16}O compound there is clear evidence for the opening of an electronic gap in the normal state at T* ≈ 170 K, far above T_c (79.0 K). Upon replacing ^{16}O with ^{18}O, the authors found that T_c decreased marginally to 78.5 K, while T* increased to about 220 K. The authors note that this huge isotope shift for T*, which is absent in NMR and NQR experiments, suggests that the mechanism leading to an isotope effect on the pseudogap has to involve a time scale in the range 10^{-13} s < τ << 10^{-8} s.

The energy spectrum of incommensurate spin fluctuations in superconducting $La_{2-x}Sr_xCuO_4$ has been studied by C.-H. Lee (Tohoku) et al. using inelastic neutron-scattering experiments. The authors observed an energy gap in the spin excitation spectrum in the superconducting state of optimally doped (x = 0.15) and slightly overdoped (x = 0.18) samples. An enhancement in χ"(ω) caused by the peak-broadening also was observed at ~6 meV, which remains at T_c. For an underdoped sample with x = 0.10 and a highly overdoped sample with x = 0.25, no clear gap was observed, even though those samples showed bulk superconductivity.

Magnetic neutron-scattering measurements of incommensurate magnetic order in a superconducting single crystal of $La_{1.88}Sr_{0.12}CuO_4$ are reported by H. Kimura (Tohoku) et al. The authors find that the incommensurate wavevectors that describe the static magnetism do not lie along high-symmetry directions of the underlying CuO_2 lattice. The positions of the elastic magnetic peaks are consistent with those found in excess-oxygen-doped La_2CuO_{4+y}. This behavior differs from the magnetic order found in the low-temperature-tetragonal $La_{1.6-x}Nd_{0.4}Sr_xCuO_4$ material, for which stripes of spin and charge have been observed. The authors stress that these observations have important implications for any stripe model proposed to describe the static magnetism in orthorhombic La_2CuO_4-based superconductors.

Measurements of the oxygen isotope effect on the in-plane penetration depth $\lambda_{ab}(0)$ in underdoped $La_{2-x}Sr_xCuO_4$ single crystals are reported by J. Hofer (Zürich) et al. The oxygen isotope effect on $\lambda_{ab}^{-2}(0)$ was found to be -10(2)% for x = 0.080 and -8(1)% for x = 0.086, arising mainly from the oxygen mass dependence of the in-plane effective mass m_{ab}. The results suggest that lattice vibrations are important for the occurrence of high-temperature superconductivity.

Measurements of the temperature dependence of the penetration depth λ_{ab} in several single crystals of $La_{2-x}Sr_xCuO_4$, $Bi_2Sr_2CaCu_2O_{8+\delta}$, and $YBa_2Cu_3O_{7-\delta}$ at various doping levels ranging from the under- to overdoped regimes have been carried out by J. Le Cochec (ESPCI Paris) et al. using a single-coil technique with a 10 pm resolution. The authors found that λ_{ab} varies linearly with T in all samples, with a rapidly increasing slope $d\lambda_{ab}/dT$ as the doping decreases. The authors' analysis of the data indicates that a superconducting gap with d-wave symmetry is sufficient to account quantitatively for the above slope values in the optimally or overdoped samples. In the underdoped samples, while the d-wave model predicts much smaller values of the slope than those observed experimentally, the data are compatible with a model of thermodynamic phase fluctuations of the order parameter.

The ab-plane optical spectra of one underdoped and one nearly optimally doped single crystal of $HgBa_2Ca_2Cu_3O_{8+\delta}$ (*Hg-1223,* T_c ≈ 135 K) in the frequency range 40-40,000 cm^{-1} have been investigated by J. J. McGuire (McMaster) et al. The authors obtained the frequency-dependent scattering rate by a Kramers-Kronig analysis of the reflectance. Both crystals were found to have a scattering-rate gap of about 1000 cm^{-1}, which is much larger than the 700 cm^{-1} gap seen in optical studies of several cuprates with maximum T_c around 93 K. The authors suggest that there is a universal scaling between the scattering-rate gap and the maximum T_c for the cuprate superconductors.

Coated Conductors

As emphasized in a preprint by M. P. Chudzik (Northwestern and Argonne) et al., the next-generation wire technology based on high-temperature superconductors requires a biaxially textured template layer on which the superconductor will be coated. These template layers will need to be lattice-matched, chemically compatible, and economically feasible for lengths up to 1 km. A major hurdle to date in bringing these wires to market has been the slow deposition rate and/or complex deposition geometry needed to deposit the template layers. In this preprint, the authors describe experiments in which biaxially textured *MgO* template layers were deposited on continuously moving Hastelloy-C tapes to a length of 0.5 m by using a collimated-flux inclined-substrate-deposition (CF-ISD) system. The feed rate of the tapes was 6.1 cm/min over a total deposition zone of 10 cm, yielding a deposition rate for continuous coating of 0.6 μm/min and an *MgO* thickness of 1.0 μm in a single pass. *MgO* films grown to a thickness of 2.0 μm have yielded in-plane textures of 10-12° full width at half maximum (FWHM).

Films

A weak spontaneous magnetic field appearing at the transition temperature of $YBa_2Cu_3O_{7-\delta}$ into the superconducting state has been observed by R. Carmi et al.

(Technion). The effect was observed in 14 out of 15 epitaxial films grown on different substrates by two different techniques. The effect indicates a breaking of both parity and time-reversal symmetries in the superconductor. The authors offer two possible interpretations: (a) the condensate carries an intrinsic magnetic moment and (b) π junctions may exist near the edges, producing circulating supercurrents and magnetic flux.

The anomalous decrease in microwave surface resistance R_S of superconducting $YBa_2Cu_3O_{7-\delta}$ films in the presence of a low dc magnetic field has been studied by X. S. Rao et al. (Singapore) using a microstrip resonator technique. From studies of the hysteresis in a dc magnetic field applied perpendicular to the film, the authors conclude that the decrease of R_S at low dc magnetic field is not due to vortices.

Magneto-optical imaging has been used by J. Albrecht et al. (MPI-Stuttgart) to investigate low-angle grain boundaries in $YBa_2Cu_3O_{7-\delta}$ thin films at 5 K. By a numerical analysis of the experimental data, the authors were able to determine the local current distribution in the grain boundary with a spatial resolution of a few µm. The authors found that the current density across the grain boundary depends strongly upon the local flux density.

The temperature dependence of the surface resistance and surface reactance of c-axis-oriented epitaxial thin films of $GdBa_2Cu_3O_{7-\delta}$ on (100)-cut $LaAlO_3$ single-crystal substrates have been measured at 10.4, 14.7, and 17.9 GHz down to 1.4 K by L. V. Mercaldo et al. (Maryland) using the parallel-plate-resonator technique. Both the resistance and the reactance data show an unusual upturn at low temperature, and the resistance shows a strong peak around T_N (≈2.2 K) mainly due to the change in magnetic permeability.

A preprint by G. I. Harus (Ekaterinburg) et al. presents a systematic study of the resistivity and Hall effect in single-crystal $Nd_{2-x}Ce_xCuO_{4-\delta}$ films ($0.12 \le x \le 0.20$), with special emphasis on the temperature dependence of the normal-state conductance. The authors found two-dimensional weak localization effects in a normal-conducting underdoped sample ($x = 0.12$), an optimally doped sample ($x = 0.15$), and an overdoped sample ($x = 0.18$) in high magnetic fields $B > B_{c2}$.

The properties of *Ca*-doped $Bi_2Sr_2CuO_6$ *(Bi-2201)* films deposited at low temperatures on heated *MgO* (100) substrates by ion-beam sputtering (IBS) are discussed in a preprint by J. Yamada et al. (Mie). The authors found that plasma cleaning of the substrate surface results in significant improvements in *Bi* incorporation and crystallinity, evidently due to early-stage nucleation.

Other Activities

The effect of the magnetic-field inhomogeneity on vibrating-sample-magnetometer (VSM) measurements of the irreversibility field of superconductors has been analyzed by I. J. Daniel and D. P. Hampshire (Durham). In a large field gradient, the hysteresis in the magnetization signal at the drive frequency of the VSM can drop to zero more than 3 T below the true irreversibility field B_{irr}. The authors also discuss implications for SQUID measurements.

Overviews

The potential and applications of high-pressure techniques in synthesizing multilayered copper oxides and related structures are discussed in a review by H. Yamauchi (Tokyo Tech) and M. Karppinen (Tokyo Tech and Helsinki University of Technology). The authors emphasize the important historical discoveries of novel phases and discuss the present status of controlled production of high-quality samples of such phases (236 refs.).

As emphasized in a review by S. M. Anlage et al. (Maryland), near-field microwave microscopy has created the opportunity for a new class of electrodynamics experiments on materials. Freed from the constraints of traditional microwave optics, experiments can be carried out at high spatial resolution (to 1 µm) over a broad frequency range (100 GHz bandwidth). In addition, the measurements can be done quantitatively, so that images of microwave materials properties can be created. The authors review the five major types of near-field microwave microscopes, discuss their own form of microscopy in detail, and present quantitative images of microwave sheet resistance, dielectric constant, and dielectric tunability. The authors also discuss future prospects for near-field measurements of microwave electrodynamic properties (76 refs.).

Contributed by John R. Clem

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TECHNOLOGY NEWS

(Also see Applications section of Nota Bene.)

This section describes progress in manufacturing, product development, and technology transfer in the high-T_c superconductivity field. Please send your contributions (product development information, news regarding technology transfer efforts, or any information you would like to share about your corporation or laboratory) to the editor.

In a recent announcement, Conductus, Inc. noted that the first urban TDMA field trials of its ClearSite® system expanded busy-hour capacity by 80% at a major cellular carrier's site in a highly populated urban area. This improvement represents a potential revenue increase of $300,000 per year, resulting in a payback of the carrier's investment in its ClearSite® system within approximately two months. ClearSite® superconducting wireless systems can expand coverage, reduce interference, and increase capacity for analog (1G), digital (2G), and next generation high-bandwidth digital (2.5G and 3G) wireless networks. In previous field trials ClearSite® systems have increased cell site minutes of use and thus revenues by 30% to more than 50% in coverage applications for 1G and 2G networks. Second-generation (2G) wireless offers increased performance and capacity over 1G networks and are widely available throughout the world from both cellular and PCS carriers. Next generation (2.5G and 3G) wireless networks will offer high-bandwidth digital service with initial 3G rollouts expected in 2001. Third-generation wireless is aimed at providing high-bandwidth digital services with speeds of 384 kbps to 2 Mbps that will support not only voice communications but also high-speed data, Internet access, and compressed video. For information, contact Conductus, Inc., 969 W. Maude Avenue, Sunnyvale, CA 94086; telephone (408) 523-9950; telefax (408) 523-9999.

Contributed by Sreeparna Mitra

PREPRINTS

To obtain a particular preprint, contact the first author at the address given at the end of the citation. Help us expand this list by sending us your complete preprint. **Please specify where and when your paper was submitted.** An * next to an entry indicates it is a correction or revision of a previous entry. PACS codes and/or key words are given at the end of the citation.

A. A. Abrikosov, "Theory of High-T_c Superconducting Cuprates Based on Experimental Evidence." Materials Science Division, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL 60439; e-mail abrikosov@anl.gov; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9912394. 74.20.Fg; 74.25.Kc; 74.62.Dh; 74.72.Bk.

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COMING EVENTS

*(An * indicates a previously listed event. Also see complete listing of upcoming conferences and workshops at our Web site http://www.iitap.iastate.edu/htcu/comevents.html.)*

March 4 - 7, 2000:* International Workshop on Latest Developments in Low-Density and Low-Dimensional Electronic Systems, Department of Physics, University of Florida, Gainesville, Fla. Main theme of the workshop is the interplay between low dimensionality, low carrier density, and transport and magnetic properties of novel materials. Program is organized in ascending dimension and includes the following topics: (0-D and 1-D) quantum dots, quantum wires, and nanotubes; (2-D) stripes in high-T_c materials, quantum Hall effect, metal-insulator transition at B=0, and superconductor-insulator transition; (3-D) itinerant ferromagnetism in low-density materials, magnetic field induced transitions, spin- and charge-density waves, and Kondo insulators. Special focus will be on the use of high magnetic fields at the National High Magnetic Field Laboratory in studies of low-density and low-dimensional materials. Invited talks and poster sessions. **Application deadline, February 1, 2000. For information, contact Alan Dorsey, 2116 New Physics Bldg., Department of Physics, University of Florida, P.O. Box 118440, Gainesville, FL 32611-8440; telephone (352) 392-4031; telefax (352) 392-0524; e-mail dorsey@phys.ufl.edu; Web-site http://www.phys.ufl.edu/workshops/ld3.html.

**March 20 - 24, 2000:* 2000 March Meeting, Minneapolis Convention Center, Minneapolis, Minn. Sessions on superconductivity will include the following topics: synthesis, growth, and processing (bulk and films); thermodynamic and transport properties; mechanical and structural properties; electronic structure and spectroscopic properties; flux pinning and flux dynamics; spin properties (NMR, NQR, etc.); tunnel junctions, devices, and Josephson arrays; quantum computing; and other focused sessions. For further general information, contact Donna Baudrau, Manager, APS Meetings Department, telephone (301) 209-3285, e-mail baudrau@aps.org; more information on the March meeting is available at the Web site http://www.aps.org/meet/MAR00/.

June 11 - 15, 2000: Superconductors for Applications, Materials Properties and Devices (ICMC'2000), Hotel Sofitel Rio Palace, Copacabana Beach, Rio de Janeiro, Brazil. Topics include materials preparation techniques, material properties, application devices, cryogenic refrigerators, and complementary materials. No parallel sessions. **Abstract deadline, February 29, 2000.** Contact Roberto Nicolsky, Conference Chair, C.P. 68515, Rio de Janeiro 21945-970, Brazil; phone +55 21 260 1092; e-mail icmc2000@lasup.dee.ufrj.br.

June 12 - 23, 2000: Workshop on Correlation Effects in Electronic Structure Calculations, Trieste, Italy. The first part of the workshop will provide a pedagogical and practical introduction to the main methods currently in use (LDA + U, DMFT, and GW) and complemented with practical demonstrations of computer codes. Second part will focus on recent methodological advances and results on specific strongly correlated materials (ruthenates, manganites, titanites, organics, bucky balls, heavy fermions and actinides etc.) Workshop is open to young research workers from all countries that are members of the United Nations, UNESCO or IAEA. Some funds are available for a limited number of people from developing countries. **Deadline for receipt of request for participation form, March 31, 2000.** Candidates should complete "Request for Participation" form (obtainable via e-mail smr1228@ictp.trieste.it or http://www.ictp.trieste.it/). Contact Ms. V. Shaw, Abdus Salam International Centre for Theoretical Physics, Workshop on Correlation Effects in Electronic Structure Calculations, Strada Costiera 11, I-34014 Trieste, Italy; telephone +39 040 2240541; telefax +39 040 224163; e-mail smr1228@ictp.trieste.it.

July 1 - 6, 2000: Future Perspectives of Superconducting Josephson Devices - EuroConference on Physics and Applications of Multi-Junction Superconducting Josephson Devices, Aquafredda di Maratea, Italy. The conference will be dedicated to an advanced discussion of the present state-of-the-art and future perspectives of superconducting Josephson electronic devices with particular attention to their impact in technological and industrial applications. Sessions will provisionally include physics of superconducting Josephson devices, flux-flow and high-frequency devices, low-frequency devices and SQUIDs, RSFQ devices, and unconventional applications. Maximum 100 participants. A number of grants available for young scientists from European Community countries and Associated States. To apply, contact Josip Hendekovic, 2 quai Lezay-Marnésia, F-67080 Strasbourg Cedex, France; phone +33 388 76 71 35; fax +33 388 36 69 87; e-mail euresco@esf.org; Web site http://www.esf.org/euresco/.

July 3 - 28, 2000: United States Summer School in Condensed Matter and Materials Physics, Boulder, Colo. New summer school for graduate students and postdocs in condensed-matter and materials physics has been established and will be held annually in Boulder. This first one is entitled *Introduction to Superconductivity: Fundamentals and Applications.* Main themes of the school will be basic principles of superconductivity, quantum dynamics of vortices and electrons, vortices in D > 2 and critical phenomena in superconductors, high-temperature and other unconventional superconductors, physics and applications of vortex dynamics, nonequilibrium superconductivity, mesoscopic and nanoscale superconducting systems, materials, applications, and devices. **Application deadline, May 1, 2000.** Most local expenses will be covered by the summer school (supported by the National Science Foundation, University of Colorado at Boulder, NIST, and Lucent). For further information, contact Z. Tesanovic, Department of Physics and Astronomy, 315 Bloomberg Center, Johns Hopkins University, 3400 North Charles Street, Baltimore, MD 21218-2686; telephone (410) 516-5391; telefax (410) 516-7239; e-mail cmsummer@pha.jhu.edu or zbt@pha.jhu.edu. For details and application forms see Web site http://www.indiana.edu/~uscmpsc/.

Sept. 13 - 16, 2000:* The Second International Conference on Inorganic Materials, University of California, Santa Barbara, Calif. Meeting will provide an opportunity to highlight recent developments and to identify emerging and future areas of growth in this field. Topics include electronic materials, structural materials and ceramics, biomaterials, intermetallics, catalytic, and porous materials. Emphasis on oral presentations by invited speakers combined with extended poster sessions. **Abstract deadline, February 25, 2000. Official language is English. A tabletop exhibition will run for the duration of the conference. For information, contact Sarah Wilkinson, Second International Conference on Inorganic Materials, Elsevier Science Ltd., The Boulevard, Langford Lane, Kidlington, Oxford, OX5 1GB, United Kingdom; telephone +44 1865 843691; telefax +44 1865 843958; e-mail sm.wilkinson@elsevier.co.uk.

Sept. 17 - 22, 2000:* The Applied Superconductivity Conference (ASC 2000), Pavilion Convention Center, Virginia Beach, Virginia. Premier conference on applied superconductivity held every two years. The meeting will highlight the latest developments and will feature invited presentations that offer an exciting look into the future. Papers solicited in three general areas of superconductivity: large scale, materials, and electronics. **Abstract deadline, February 11, 2000. All abstracts must be submitted electronically. Further information available at the Web site http://www.ascinc.org.

RESOURCES

Products and Services

New software: *Virtual Instruments* has recently announced development of new software for resistivity measurements. Ariadne is a software solution for applications involving measurements of the resistivity tensor of anisotropic conducting media by multiterminal technique. The method has evolved in recent years in response to the great interest in properties of such highly anisotropic materials as high-temperature superconductors, crystals exhibiting colossal magnetoresistance, etc. In this method, the electrical current is injected into a sample of a given geometry, and the voltage drops between pairs of voltage contacts attached to the surface of the sample are measured. Then, one has to find the distribution of the electrical potential inside the sample as a function of unknown components of the resistivity tensor and to solve numerically the inverse problem, thus determining these components from the measured voltages. This procedure is the main function of Ariadne. Free trial download is available. For information, contact Virtual Instruments, 150 East 39th Street, Suite 804, New York, NY 10016; e-mail info@virtinst.com; Web site http://www.virtinst.com/.

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