HIGH T_C UPDATE

VOL. 13, NO. 9
MAY 1, 1999

DMS/BES/DOE
ARPA

NOTA BENE:

Happy Birthday to us! High-T_C Update begins its 13th year with this issue. This issue also begins a new era for us as we go completely digital. Thank you for your support, encouragement, and preprints!

A hearty thank you to American Superconductor Corporation for becoming a *High-T_C Update* Web sponsor with a contribution of $2,000!

$Na_{0.05}WO_3$

Experiments by S. Reich and Y. Tsabba (Weizmann Institute) suggest the possibility of superconductivity with $T_C \approx 91$ K in WO_3 crystals with a surface composition of $Na_{0.05}WO_3$. The authors prepared single crystals with surfaces doped with Na^+ ions following the method described by I. Lefkowitz et al., *J. Solid State Chem.* **15**, 24 (1975). WO_3 powder containing 0.5% atomic concentration of sodium was placed in platinum tubes of length 10 cm and inner diameter 0.5 cm. The tubes were sealed at both ends, heated in a tube furnace in which the temperature gradient was ≈5°C/cm, and kept at 1370°C for 30 h. The samples next were cooled to 1230°C at 2°C/h and finally to room temperature at 80°C/h. The resulting crystals had cubic morphology, were a few hundred μm in size, and had a deep olive-green color. Analysis by x-ray and XPS showed the samples to have the WO_3 perovskite-like structure and a surface enrichment of sodium to a 5% atomic concentration; the surface composition was thus $Na_{0.05}WO_3$. The authors note that in ternary materials such as these, the surface composition may differ significantly from that in the bulk. The XPS spectrum revealed a finite electron density near the Fermi level, evidently due to sodium doping, since stoichiometric WO_3 is an insulator.

Measurements in a SQUID magnetometer of the zero-field-cooled (ZFC) magnetic moment vs temperature in a magnetic field of 100 Oe showed the sample to be diamagnetic at temperatures above 91 K and to become sharply more diamagnetic below 91 K. (The authors did the necessary experiments to exclude the possibility of contamination by $YBa_2Cu_3O_{7-\delta}$, which has a $T_C \approx 91$ K.) In a field of 1000 Oe, the diamagnetic step was found to be diminished in magnitude, and the transition temperature was lowered by about one degree. The authors also measured the magnetization vs magnetic field at fixed temperatures. At 120 K, the magnetic moment was linear in magnetic field, diamagnetic, and nonhysteretic. At 70 K, the magnetic moment was found to be nonlinear and weakly hysteretic, with both the field-increasing and field-decreasing magnetic moments being more diamagnetic than the corresponding magnetic moment at 120 K.

The authors also report four-point transport resistance measurements of a Na^+-doped single crystal of WO_3 using a current of 10 nA in a voltage-limiting mode of 10 V. In zero magnetic field, the resistance showed a semiconductor-like behavior above 100 K. The resistance had a maximum of about 300 MΩ at 100 K and showed a sharp decrease at temperatures below 100 K to a nearly constant value of about 100 MΩ below about 50 K. In a magnetic field of 10^4 Oe, similar behavior was found, except that the resistance above 100 K was larger, the resistance at the maximum at 100 K was about 700 MΩ, and the resistance had a nearly constant value of about 300 MΩ below about 80 K.

Measurements of the ZFC magnetic moment vs temperature in 100 Oe were compared for (a) bare crystals, (b) crystals coated with a sputtered layer of pure gold, and (c) crystals coated with an additional sputtered layer of gold. The authors found that the magnitude of the diamagnetic step below 91 K was suppressed as the gold thickness increased.

The authors conclude by suggesting that they have observed on the surface of an insulator (a bulk WO_3 crystal) a transition at 91 K from a semiconducting to a 2D superconducting state upon surface doping with sodium.

Qubit

As noted in a preprint by Y. Nakamura (NEC) et al., a small superconducting electrode (a single-Cooper-pair box) connected to a reservoir via a Josephson junction constitutes an artificial two-level system, in which two charge states that differ by 2e are coupled by tunneling of Cooper pairs. Despite its macroscopic nature involving a large number of electrons, this two-level system shows coherent superposition of the two charge states and thus has been suggested as a candidate for a qubit, i.e., a basic component of a quantum computer. The authors report time-domain observations of the coherent quantum-state evolution of such a device realized at 30 mK using a superconducting 700 nm $\times$ 50 nm $\times$ 15 nm *Al* strip (containing ~10^8 conduction electrons) connected to a superconducting *Al* reservoir via a SiN_x Josephson junction. The authors assert that their results demonstrate coherent operation and measurement of the quantum state of a single two-level system, i.e., a qubit, in a solid-state electronic device.

Vortices

The transport of 2D vortex rows through easy-flow channels in an otherwise perfect, but pinned vortex lattice has been studied by R. Besseling et al. (Leiden) using molecular dynamics simulations and comparisons with the Frenkel-Kontorova model. The authors find that when the vortex lattice in the channel is incommensurate with the pinned vortex lattice, the motion of point defects in the moving vortex lattice causes the critical current to be drastically reduced relative to the critical current when the vortex lattice in the channel is commensurate with the pinned vortex lattice.

From muon spin-rotation (μSR) measurements on three sets of underdoped (T_c = 64 K), almost optimized (T_c = 90 K), and overdoped (T_c = 77 K) $Bi_2Sr_2CaCu_2O_{8+\delta}$ *(Bi-2212)* crystals, T. Blasius (Konstanz) et al. have obtained evidence for a two-stage transition of vortex matter as a function of temperature. One of the transitions, which is well known, is related to the irreversibility line (IL) and is interpreted as the interplanar decoupling of pancake vortices, resulting in a pancake gas phase with reversible magnetic behavior. A second transition, located at a lower temperature T_m well below the IL, was found to occur for all three sets of crystals and to be unrelated to the vortex mobility. The authors interpret this transition as arising from intraplanar melting of the vortex structure into a liquid phase of vortex lines.

A preprint by A. K. Pradhan et al. (SRL-ISTEC) reports the observation of a first-order melting transition of the vortex lattice in a twinned $NdBa_2Cu_3O_{7-\delta}$ *(NBCO)* single crystal by transport and magnetization measurements. The positions of the magnetization jump and the kink and hysteresis in resistance coincide in the B-T plane. The authors found that the melting transition is a strong function of the O_2 partial pressure during sample preparation.

Current-voltage characteristics in $Bi_2Sr_2Ca_{1-x}Y_xCu_2O_8$ crystals irradiated parallel to the c axis with 5.8 GeV *Pb* ions to produce columnar defects have been investigated by L. Ammor (Tours) et al. For weak magnetic fields ($B < B_\phi$) the authors find that the isothermal I-V curves scale according to the Bose-glass (BG) theory for correlated disorder.

The phase boundary separating the Bose-glass and vortex-liquid phases in an irradiated twin-free $YBa_2Cu_3O_{7-\delta}$ single crystal has been mapped out by A. W. Smith (Chicago) et al. The authors define the phase boundary as the temperature T_g and magnetic field H at which the crystal begins to screen a small ac magnetic field h_{ac}. The authors find that there is a sharp change in slope dT_g/dH of the phase boundary at the matching field B_ϕ ($\approx$0.5 T), indicating that interstitial vortices significantly weaken pinning in the Bose-glass state. This feature disappears when the field is tilted relative to the columnar defects.

An angular-dependent contribution to the equilibrium magnetization of an $YBa_2Cu_3O_{7-\delta}$ single crystal containing columnar defects created by 5.8 GeV *Pb* ions has been measured by L. Fruchter (Orsay) et al. This contribution, which is observed in a narrow temperature interval less than 2 K wide and for fields up to about twice the irradiation field B_ϕ, can be used to estimate the pinning potential created by the columnar defects.

According to a preprint by B. Horovitz (Ben-Gurion University of the Negev), the second magnetization peak in vortex lattices in layered superconductors is due to a disorder-induced layer-decoupling transition. For weak disorder, the tilt modulus undergoes an apparent discontinuity, which leads to an enhanced critical current and reduced domain size in the decoupled phase. The Josephson plasma frequency is reduced by decoupling and by Josephson glass pinning; in the liquid phase it varies as $1/[B(T+T_0)]$, where B is the magnetic field, T is the temperature, and T_0 is the disorder-dependent temperature of the multicritical point.

A preprint by I. Vekhter (Guelph) and A. Houghton (Brown) presents results of a microscopic calculation of the longitudinal thermal conductivity κ_{xx} of a d-wave superconductor in the vortex state. The results show an increase in the thermal conductivity with applied field at low temperatures, and a decrease followed by a nearly field-independent $\kappa_{xx}(H)$ at higher temperatures, in qualitative agreement with the experimental results.

Small-angle neutron-scattering (SANS) and magnetization measurements have been carried out by I. Joumard et al. (Grenoble) on the cubic superconductor $Ba_{1-x}K_xBiO_3$

(BKBO). The authors found that the vortex lines are ordered into a hexagonal lattice at low field ($B < B_e \sim 0.6$ T) but that the diffracted intensity continuously drops to zero as B approaches B_e. The authors attribute the intensity drop to a static Debye-Waller factor associated with disorder-induced longitudinal fluctuations of the vortex lines. They also note that B_e lies close to the onset of the anomalous peak effect in the magnetization, suggesting that this peak is related to the change in structure of the vortex solid.

A preprint by A. Conde-Gallardo (Grenoble and Mexico) et al. presents ac susceptibility measurements on *BKBO* single crystals with different geometries: thick films, bars, and hollow cylinders. The authors also compare their results with theory.

$RBa_2Cu_3O_{7-\delta}$

The temperature dependence of the c-axis optical conductivity $\sigma(\omega)$ of optimally and overdoped $YBa_2Cu_3O_x$ ($x = 6.93$ and 7) has been measured by M. Grüninger (Groningen) et al. in the far- (FIR) and mid-infrared (MIR) range. Below T_c the authors observe a transfer of spectral weight from the FIR not only to the condensate at $\omega = 0$, but also to a new peak in the MIR. The authors explain this peak as a transverse out-of-phase bilayer plasmon using a model for $\sigma(\omega)$ that takes the layered crystal structure into account. With decreasing doping the plasmon shifts to lower frequencies and can be identified with a puzzling FIR feature previously reported in underdoped bilayer cuprates.

As reported by D. Munzar (MPI-Stuttgart) et al., the spectra of the far-infrared c-axis conductivity of underdoped $YBa_2Cu_3O_x$ ($6.4 \le x \le 6.8$) crystals exhibit dramatic changes of some of the phonon peaks when going from the normal to the superconducting state. Extending the model of D. van der Marel and A. Tsvetkov, *Czech. J. Phys.* **46**, 3165 (1996), the authors show that the most striking of these anomalies can be naturally explained by changes of the local fields acting on the ions arising from the onset of inter- and intra-bilayer Josephson effects.

Current-voltage characteristics of a $YBa_2Cu_3O_{6.95}$ single crystal have been measured by A. V. Bondarenko (Kharkov State) et al. for dc current densities up to 3×10^4 A/cm^2. No anomalous behavior was observed for the depinning critical current density J_{cd} estimated within the Bardeen-Stephen model, in contrast to the fishtail behavior of the critical current density J_{cE} determined using the electric-field criterion E = const. After obtaining the field dependence of the activation energy U and the exponent μ from $E \propto \exp[-(U/k_BT)(J_{cd}/J)^{\mu}]$, the authors show that the minimum in $J_{cE}(H)$ corresponds to a crossover from single-vortex to small-bundle creep, while the maximum in $J_{cE}(H)$ corresponds to a crossover from elastic to plastic creep.

The magnetic-field dependence of the specific heat of *Zn*-doped single crystals of $YBa_2Cu_3O_{6.95}$ has been measured by D. L. Sisson (Stanford) et al. in the temperature range 2-10 K in fields up to 8 T. The authors studied and compared the behavior for doping levels of 0%, 0.15%, 0.31%, and 1%. No Schottky anomaly was observed for the presumed magnetic moments created by *Zn* doping. The authors present evidence that the *Zn* moments in *YBCO* crystals are screened by quasiparticles in the nodes of the $d_{x^2-y^2}$ superconductor.

$Y_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$ ($x = 0.30$ and 0.45) has been studied by Z. Homonnay (Budapest) et al. via emission Mössbauer spectroscopy using ^{57}Co dopant. The results support a phonon-assisted mechanism for high-T_c superconductivity in *R-123* compounds, with a significant contribution from the chains.

The magnetic hysteresis loops of top-seeded melt-grown $YBa_2Cu_3O_{7-\delta}$ superconductors with Pr_6O_{11} additions have been studied by E. S. Reddy et al. (Tokyo). The authors observed an intermediate peak in $J_c(H)$, which shifted toward lower fields with decreasing temperature. The authors propose a model, based on temperature-dependent pinning centers, to explain the peak position with temperature.

Bi Cuprates

A preprint by Y.-D. Chuang (Colorado) et al. presents a re-examination of the electronic structure and Fermi surface of $Bi_2Sr_2CaCu_2O_{8+\delta}$ *(Bi-2212)* and $Bi_2Sr_2CuO_6$ *(Bi-2201)* as obtained from angle-resolved photoemission spectroscopy (ARPES). By applying a stricter set of Fermi-surface crossing criteria and by varying the incident photon energy outside the usual range, the authors find very different behavior from that previously observed. In particular, the authors find an electron-like Fermi surface centered around the Γ point (0,0) and conclude that the flat bands at E_F near $(\pi,0)$ are absent. The authors report that these results are robust over a large range of dopings for both single- *(Bi-2201)* and double-layer *(Bi-2212)* cuprates.

A 590 cm^{-1} peak in the B_{1g} Raman spectrum has been observed by K. C. Hewitt (Simon Fraser) et al. in single-crystal $Bi_2Sr_2CaCu_2O_{8+\delta}$ *(Bi-2212)* that is underdoped by oxygen removal. This feature is found to soften in frequency by 3.8% upon isotopic exchange of ^{16}O by ^{18}O, indicating that the 590 cm^{-1} feature is vibrational in origin and not associated with pseudogap formation. The 590 cm^{-1} peak is not observed in crystals underdoped by *Y* substitution.

A study by O. V. Misochko (Communications Research Lab) et al. of the electronic Raman spectra of deliberately disordered $Bi_2Sr_2Ca(Cu_{1-x}Fe_x)_2O_{8+\delta}$ crystals has revealed that the static ($\omega \to 0$) limits of the ratio between the A_{1g} Raman susceptibilities from the superconducting and normal

states show the universality expected for a gap with nodes. In addition, the B_{1g} channel, where the static limits are slightly varied by the disorder, is also independent of impurity concentration for the low-frequency Raman susceptibility, suggesting that the nodes are shifted from the positions predicted by pure d-wave symmetry.

Electron-tunneling spectroscopy of slightly over-doped $Bi_2Sr_2CaCu_2O_{8+\delta}$ *(Bi-2212)* single crystals with T_c = 87-90 K has been carried out by A. Mourachkine (Belgium) in the temperature range 14-290 K using a break-junction technique. The author detected the pseudogap below $T^* \approx 280$ K. An additional contribution to the pseudo-gap is found in the temperature range between T_c and 115 K, which the author attributes to incoherent Cooper pairs.

A preprint by Y. Kopelevich (Unicamp) et al. reports pronounced jumps of thermomagnetic origin in the irreversible magnetization of superconducting $Bi_2Sr_2CaCu_2O_{8+\delta}$ *(Bi-2212)* single crystals at T > 40 K. In addition, at T < 40 K, the magnetization hysteresis loops show a second magnetization peak, which the authors attribute to a thermomagnetic instability effect. Both the magnetization jumps and the second magnetization peak vanish simultaneously when the crystal size is reduced. The authors suggest that plastic vortex motion triggers the instabilities.

Estimates of the irreversibility line using dc magnetization measurements in an as-prepared, optimally doped ($T_c \approx 109$ K) and an oxygen-reduced ($T_c \approx 104$ K) single-phase c-axis-oriented powder sample of $Bi_{1.7}Pb_{0.3}Sr_2Ca_2Cu_3O_{10+\delta}$ have been made by G. Kallias et al. (IMS, Athens). The irreversible region of the H vs T phase diagram extends to higher temperatures in the as-prepared sample.

Other Cuprates

A process for the fabrication of $HgBa_2CuO_{4+\delta}$ *(Hg-1201)* with a microstructure similar to that of melt-processed $YBa_2Cu_3O_{7-\delta}$ *(Y-123)* is reported by E. S. Reddy et al. (Tokyo). The process involves two steps: (a) melt-processing of the precursor, Ba_2CuO_3, and (b) incorporation of *Hg* into Ba_2CuO_3 in a closed atmosphere. The pinning of vortices in *Hg-1201* by micron-sized particles of *BaO* is similar to the pinning of vortices in *Y-123* by micron-sized particles of Y_2BaCuO_5 *(Y-211).*

Two related papers, one by M. Pissas (IMS, Athens) et al. and the other by D. Stamopoulos (IMS, Athens) report magnetization measurements on $HgBa_2CuO_{4+\delta}$ *(Hg-1201)* single crystals and their interpretation in terms of the activation energy U(H,T).

Measurements of the thermal conductivity κ vs temperature and doping for several cuprate superconductors are reported by J. L. Cohn (Miami). The author attributes suppressed values of the normal-state κ and the temperature derivative of κ at T_c, observed near 1/8 doping in both $YBa_2Cu_3O_{7-\delta}$ and *Hg* cuprates, to local lattice distortions and the suppression of the superconducting condensate, respectively. Both phenomena are supposed to arise from small domains of localized planar holes, presumably a manifestation of phase separation. The author suggests that the phase behavior of κ reflects stripe dynamics and that the 1/8 doping anomalies reflect stripe pinning by oxygen-vacancy clusters.

A preprint by J. M. Tranquada (Brookhaven) et al. notes that charge segregation provides a way to reconcile the coexistence of local antiferromagnetism and superconductivity in the cuprates. Direct evidence for modulated spin and charge densities has been found in neutron and x-ray scattering studies of *Nd*-doped $La_{2-x}Sr_xCuO_4$. The authors discuss the nature of the modulations and present some new results for *Zn*-doped $La_{2-x}Sr_xCuO_4$. The authors also discuss some of the open questions concerning the connections between segregation and superconductivity.

Films

A triple sign reversal in the mixed-state Hall effect has been observed by W. N. Kang (POSTECH and TCSUH) et al. in ion-irradiated $HgBa_2CaCu_2O_{6+\delta}$ *(Hg-1212)* thin films. The negative dip at the third sign reversal is more pronounced for higher fields, in contrast to the behavior at the first sign reversal near T_c in most high-T_c superconductors. These observations can be explained by a recent prediction in which the third sign reversal is attributed to the energy derivative of the density of states and to a temperature-dependent function related to the superconducting energy gap. These contributions prominently appear in cases where the mean-free path is significantly decreased, such as in the present case of ion-irradiated thin films.

As reported by U. Scotti di Uccio et al. (Napoli), single-domain, biaxially oriented (103) $YBa_2Cu_3O_{7-\delta}$ *(YBCO)* films have been grown on biaxially oriented $SrTiO_3$ *(STO)* buffer layers grown on vicinal (110) *MgO* substrates. The authors used reciprocal-space mapping and x-ray diffraction to demonstrate that the *STO* buffer layers grown on vicinal *MgO* have a (110) orientation, and that they preserve the vicinal cut of the substrate.

Applications

For ac power-engineering applications, the energy dissipation in the superconductor is dominated by the magnetization due to alternating fields. To reduce these ac losses, M. P. Oomen (Siemens) et al. have been developing

Bi-2223 tapes with twisted filaments and an increased matrix resistivity. The authors find that estimates of the coupling-current magnitude based on short nontwisted-tape samples cannot be directly transferred to twisted-filament tapes because of differences in the coupling mechanisms.

The development of a high-temperature superconducting 110 kV / 400 MVA cable for future power transmission systems in densely populated areas is reported in a preprint by M. Leghissa (Siemens) et al. The cable consists of coaxial conductors made of *(Bi,Pb)-2223* multifilament tapes, liquid-nitrogen-temperature high-voltage insulation, a flexible cryostat, terminations, and a liquid-nitrogen cooling system. The authors report critical currents, the current distribution among the layers, and ac losses of a single-phase, four-layer cable.

A low-cost experiment to measure the interaction force between a high-temperature superconductor and a permanent magnet is described in a paper by S. O. Valenzuela et al. (Buenos Aires). The authors show how both levitation and suspension can be demonstrated and quantified.

Measurements of the harmonic power on a suspended stripline microwave resonator patterned out of thin-film $YBa_2Cu_3O_{7-\delta}$ *(YBCO)* have been carried out by D. P. Choudhury (Northeastern and AFRL, Hanscom AFB) et al. as a function of temperature and microwave power. The third harmonic power P_3 shows a subtle nonlinear dependence on the fundamental power P_1 on a log-log scale. Fits to a straight line yield slopes of P_3 vs P_1 between 1.5 and 3.

The use of a high-T_c SQUID magnetometer to observe chemomagnetism, the generation of a magnetic field by rapid, high-temperature solid combustion reactions, is reported in a preprint by M. D. Nersesyan et al. (TCSUH). Magnetic fields were observed during the synthesis of both ferromagnetic (ferrite) and nonferromagnetic compounds. The magnetic field was most likely produced by ionic currents due to chemoionization processes within and behind the moving high-temperature reaction zone.

Theory

The superconducting critical temperature T_c of small-coherence-length superconductors is calculated in a paper by M. Cyrot (Grenoble). The author uses a mode-mode-coupling approximation to show that T_c is much smaller than the BCS mean-field critical temperature T_0. In the quasi-two-dimensional case, fluctuations are strongly increased and T_c is further reduced. This leads to a range of temperatures between T_c and T_0 where a pseudogap can be observed. For the case of the superconducting cuprates, the author argues that anisotropy of the order parameter not only increases fluctuations and decreases T_c, but also leads to (a) the effective number of superconducting electrons being much smaller than the actual number of electrons, (b) an increase of the penetration depth λ, and (c) a justification of Uemura's empirical relation stating that T_c is proportional to $1/\lambda^2$.

A preprint by A. V. Balatsky (Los Alamos) shows that a complex d_{xy} component is generated in d-wave superconductors in a magnetic field. As one enters the superconducting state at finite field, a normal-to-superconducting transition occurs into a bulk $d_{x^2-y^2} + id_{xy}$ state. The driving force for this transition is the linear coupling between the magnetic field and the nonzero magnetization of the $d_{x^2-y^2} + id_{xy}$ condensate. The external magnetic field violates parity and time-reversal symmetries, and the nodal quasiparticle states respond by generating the id_{xy} component of the order parameter, with the magnitude estimated to be on the order of a few kelvin. Parity (P) and time-reversal (T) symmetries are violated in this state.

Using the framework of the cell-perturbation method for the original p-d model, Z. Kovacevic et al. (JINR-Dubna) have derived an effective two-band Hubbard model for the CuO_2 plane with *Zn* impurities. The *Zn* impurities are modeled by Wannier oxygen one-hole states at vacant *Cu* sites. The model is based on the results of band-structure calculations carried out within the local-density approximation. A further reduction to an extended t-J model shows a large ferromagnetic superexchange interaction between the *Cu* spin with the nearest virtual oxygen spin in the *Zn* cell.

Two papers by S. Alam (KEK, Tsukuba) discuss the consequences of the author's conjecture that high-temperature superconductivity and antiferromagnetism can be modeled by quantum groups.

Variational wave functions for Fermi systems in any dimension are proposed by B. S. Shastry (Bangalore). These wave functions introduce correlations between Cooper pairs in different momentum states, and the relevant correlations can be computed analytically. The author finds large enhancements in the Cooper pair correlation function caused by the interplay between the uncertainty principle, repulsion, and the proximity of half filling.

A preprint by N. Andrenacci (Camerino) et al. investigates the zero-temperature BCS to Bose-Einstein crossover at the mean-field level, driving it with not only an attractive potential but also the particle density. The authors considered three different interparticle potentials for the continuum model in three spatial dimensions, and analyzed both s- and d-wave solutions for the attractive (extended) Hubbard model on a two-dimensional square lattice. For the latter d-wave model in the strong-coupling limit near half filling, the authors found evidence for strong

correlations among antiparallel-spin fermions belonging to different composite bosons, giving rise to quasi-long-range antiferromagnetic order in this limit.

The proximity effect, quasiparticle transport, and local magnetic moment in ferromagnet/d-wave superconductor junctions with {110}-oriented interfaces have been studied by J.-X. Zhu (TCSUH) and C. S. Ting (TCSUH and NCTS-Hsinchu), who self-consistently solved the Bogoliubov-de Gennes equations with an extended Hubbard model. The authors found that the proximity-induced order parameter oscillates in the ferromagnetic region. The modulation period is shortened with increasing exchange field, and the oscillation amplitude is depressed by interfacial scattering. Using the resulting energy gap, the authors use a transfer-matrix method to compute the subgap conductance. The authors calculate the zero-bias conductance dip and splitting with appropriate values of the exchange field and interfacial scattering strength. The authors find that the conductance spectrum can be strongly influenced by spin-flip interfacial scattering. The authors also find a sizable local magnetic moment near the {110}-oriented surface of the d-wave superconductor.

Two phenomena in a weakly coupled superconductor under applied stress, based on a recently suggested piezophase effect (the macroscopic quantum analog of the piezoelectric effect) in mechanically loaded grain-boundary Josephson junctions, are predicted in a preprint by S. A. Sergeenkov (Dubna): (a) a stress-induced paramagnetic moment in zero applied magnetic field (piezomagnetism) and (b) its influence on the low-field magnetization (leading to a mechanically induced paramagnetic Meissner effect).

A delocalization transition for noninteracting quasiparticles moving in two dimensions, belonging to a new symmetry class, has been studied by V. Kagalovsky (Beer-Sheva) et al. This symmetry class can be realized in a dirty, gapless superconductor in which time-reversal symmetry for orbital motion is broken, but spin-rotation symmetry is intact.

Other Activities

The quasi-two-dimensional, layered organic superconductors are of interest to many researchers, despite their relatively low T_c, because many of their properties resemble those of the high-temperature cuprate superconductors. Four papers concerning these materials are listed in this issue. Measurements of the upper critical field and Pauli paramagnetic limiting in magnetic fields parallel to the layers of κ-*(BEDT-TTF)$_2$Cu(SCN)$_2$* are reported by F. Zuo (Miami) et al. Measurements of the ac susceptibility of single crystals of κ-*(BEDT-TTF)$_2$Cu[N(CN)$_2$]Br* suggesting d-wave superconductivity are reported by M. Pinteric (Zagreb and Maribor) et al. Transport measurements of the interlayer magnetoresistance of κ-*(BEDT-TTF)$_2$I$_3$* and modeling in terms of the stacked Josephson-junction model are reported by F. Zuo (Miami) et al. The consequences of a theoretical model for spin-fluctuation-induced d-wave superconductivity in κ-*(BEDT-TTF)$_2$X,* where *X = Cu[N(CN)$_2$]Br* or *Cu[N(CN)$_2$]Cl,* are worked out in a paper by H. Kondo and T. Moriya (Science University of Tokyo).

Overviews

An experimental review of the nature of the pseudogap in the cuprate superconductors has been prepared by T. Timusk (McMaster) and B. Statt (Toronto). The authors note that the pseudogap is seen in all high-temperature superconductors and that there is general agreement on the temperature and doping range where it exists. It also appears that the superconducting gap emerges from the normal-state pseudogap and that the d-wave nature of the order parameter holds for both the superconducting gap and the pseudogap. Despite the extensive body of experimental evidence, there is still no consensus on either the origin of the pseudogap or the mechanism underlying high-temperature superconductivity (191 refs.).

A review by T. Timusk (McMaster) examines several families of unconventional superconductors from the point of view of infrared spectroscopy. The author compares the behavior of BCS superconductors, such as *Pb,* with that of *Ba$_{1-x}$K$_x$BiO$_3$ (BKBO), Sr$_2$RuO$_4$, URu$_2$Si$_2$,* the cuprates, and the organic superconductors. The author focuses on several markers of deviation from classic phonon-coupled superconductors: (a) the collapse of scattering at T_c, (b) the growth of a Drude peak in the superconducting state of dirty samples and the absence of a 2Δ gap feature, (c) the role of intrinsic dimensionality, and (d) the presence of a pseudogap in the normal state (58 refs.).

A summary by T. Venkatesan (Maryland) et al. discusses three experiments (ion-channeling studies of ion dynamics, optical excitation studies of electron dynamics, and spin-polarized quasiparticle injection into high-temperature superconductors) that bring out some of the important similarities and differences between the high-temperature superconducting (HTS) cuprates and colossal magnetoresistive (CMR) manganites (43 refs.).

Some recent experiments that provide support for the concept of topological doping in cuprate superconductors are discussed in a brief overview by J. M. Tranquada (Brookhaven). The author argues that, consistent with the idea of charge segregation, the scattering associated with the "resonance" peak found in *YBa$_2$Cu$_3$O$_{7-\delta}$* and *Bi$_2$Sr$_2$CaCu$_2$O$_{8+\delta}$* comes from the *Cu* spins and not from the doped holes (32 refs.).

Contributed by John R. Clem

High-T_C Update **is available without charge to interested persons. Recipients are expected to participate in this information exchange by sending us preprints, reprints, meeting news, research news, etc. Contributions to defray the cost of newsletter printing and mailing are welcome.**

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.

Four HTS coils that will serve as the key component in the 1,000-hp commercial-scale HTS motor project have been shipped by American Superconductor Corporation (ASC) to Reliance Electric, a business unit of Rockwell Automation. ASC will now manufacture HTS wire for the next prototype motor, which will have a power output of 5,000 hp. Based on the company's perspective of the needs for HTS wires in electric power applications over the next few years, ASC has already implemented plans for doubling its manufacturing capacity to 500,000 meters per year within the next 12 months. The first 1,000 horsepower motor, to be manufactured by Reliance Electric, will be an ac synchronous, air-core design. Four HTS coils will be mounted on the rotor, designed to rotate at 1,800 rpm. Cooling of the HTS rotor coils will be accomplished by a cryo refrigerator, also to be supplied by American Superconductor. This first-of-a-kind HTS motor will undergo extensive testing and evaluation over the next six to nine months, at the conclusion of which Reliance plans to place it in an industrial beta site while the 5,000-hp motor is manufactured. The 5,000-hp motor will be the commercial entry point for this product.

The 1,000 and 5,000 horsepower motors are being developed under the auspices of a U.S. Department of Energy program known as the Superconductivity Partnership Initiative (SPI), a program that is a collaborative effort by government and private industry designed to accelerate the introduction of HTS electric power devices to the marketplace. The SPI brings together teams of researchers, manufacturers, systems integrators, and end users to develop and demonstrate a variety of HTS applications, including motors, generators, power cables, and transformers. Contact Stan Piekos, American Superconductor Corporation, Two Technology Drive, Westborough, MA 01581; telephone (508) 621-4220; e-mail spiekos@amsuper.com.

An initial purchase order for 25 SuperFilter ® Systems has been received by Superconductor Technologies Inc. (STI), from United States Cellular Corporation. Based in Chicago, United States Cellular Corporation, one of the nation's ten largest cellular service providers, manages and invests in cellular systems throughout the United States. For more information contact Jim Evans, Jr., Superconductor Technologies Inc., 460 Ward Drive, Suite F, Santa Barbara, CA 93111-2310; telephone (805) 683-7646; Web site http://www.suptech.com.

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.

Sher Alam, "A Conjecture for Possible Theory for the Description of High Temperature Superconductivity and Antiferromagnetism." Preprint #KEK-TH-607. KEK High Energy Accelerator Research Organization, 1-1 Oho, Tsukuba-shi, Ibaraki-ken 305-0801, JAPAN; telephone +81 298 64 5403; telefax +81 298 64 5755; e-mail sher@ccthmail.kek.jp or sher@ccth2.kek.jp; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9812060. Key words: superconductivity, antiferromagnetism, quantum groups.

Sher Alam, "Quantum Group Based Modeling for the Description of High Temperature Superconductivity and Antiferromagnetism." Preprint #KEK-TH-613. KEK High Energy Accelerator Research Organization, 1-1 Oho, Tsukuba-shi, Ibaraki-ken 305-0801, JAPAN; telephone +81 298 64 5403; telefax +81 298 64 5755; e-mail sher@ccthmail.kek.jp or sher@ccth2.kek.jp; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9903038.

Sher Alam and M. O. Rahman, "Theoretical Modeling for Quantum Liquids from 1D to 2D Dimensional Crossover Using Quantum Groups." Preprint #KEK-TH-619. KEK High Energy Accelerator Research Organization, 1-1 Oho,

Tsukuba-shi, Ibaraki-ken 305-0801, JAPAN; telephone +81 298 64 5403; telefax +81 298 64 5755; e-mail sher@ccthmail.kek.jp or sher@ccth2.kek.jp; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9903455.

L. Ammor, J. C. Soret, R. De Sousa, V. Ta Phuoc, G. Villard, A. Ruyter, A. Wahl, and E. Olive, "Vortex Phase Diagram of $Bi_2Sr_2Ca_{1-x}Y_xCu_2O_\delta$ in the Presence of Columnar Defects." Submitted to Physica C. Laboratoire d'Electrodynamique des Matériaux Avancés, Université F. Rabelais, UFR Sciences, Parc de Grandmont, F-37200 Tours, FRANCE; phone +33 2 47 36 6932; fax +33 2 47 36 6947; e-mail ammor@delphi.phys.univ-tours.fr. Key words: flux pinning, I-V characteristics, phase diagram, irradiation effect, irreversibility line. 74.72.Hs; 74.60.Ge; 74.62.Dh.

N. Andrenacci, A. Perali, P. Pieri, and G. C. Strinati, "Density-Induced BCS to Bose-Einstein Crossover." Diparti-mento di Matematica e Fisica, Sezione INFM, Università di Camerino, I-62032 Camerino, ITALY; A. Perali's e-mail at Università di Roma andrea.perali@roma1.infn.it; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9903399.

A. V. Balatsky, "Field Induced $d_{x^2-y^2} + id_{xy}$ State and Marginal Stability of High-T_c Superconductors." Preprint #LA-UR-99-1326. T-11, MS B262, Los Alamos National Laboratory, Los Alamos, NM 87545; telephone (505) 665-0077; telefax (505) 665-4063; e-mail avb@viking.lanl.gov; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9903271. 74.20.-z; 74.25.Dw.

R. Besseling, R. Niggebrugge, and P. H. Kes, "Transport Properties of Vortices in Easy Flow Channels: A Frenkel-Kontorova Study." To be published in Phys. Rev. Lett. Kamerlingh Onnes Laboratorium, Leiden University, P.O. Box 9504, 2300 RA Leiden, THE NETHERLANDS; e-mail rbessel@phys.leidenuniv.nl; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9903360. 74.60.Ge; 74.60.Jg; 62.20.Fe.

T. Blasius, Ch. Niedermayer, J. L. Tallon, D. M. Pooke, A. Golnik, and C. Bernhard, "Evidence for a Two-Stage Melting Transition of the Vortex Matter in $Bi_2Sr_2Ca_1Cu_2O_{8+\delta}$ Single Crystals Obtained by Muon Spin Rotation." Fakultät für Physik, Universität Konstanz, D-78434 Konstanz, GERMANY; e-mail thomas.blasius@uni-konstanz.de; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9903232. 74.60.Ge; 74.25.Dw; 74.72.Hs; 76.75.+i.

A. V. Bondarenko, A. A. Prodan, M. A. Obolenskii, R. V. Vovk, M. Pissas, G. Kallias, D. Niarchos, and T. R. Arouri, "Current-Voltage Characteristics in the Vicinity of the Fishtail Peak in $YBa_2Cu_3O_{6.95}$ Single Crystals." To be published in Physica C (in press). Contact M. Pissas, Institute of Materials Science, National Center for Scientific Research "Demokritos," 15310 Ag. Paraskevi, Athens, GREECE; telephone +30 1 6503 306; e-mail mpissas@ims.demokritos.gr. Key words: current, voltage, critical current. 74.60.-w; 74.72.Bk.

Michael Brunner, Fakher F. Assaad, and Alejandro Muramatsu, "Single Hole Dynamics in the One Dimensional t-J Model." Institut für Theoretische Physik III, Universität Stuttgart, Pfaffenwaldring 57, D-70550 Stuttgart, GERMANY; telephone +49 711 685 5208; telefax +49 711 685 5098; e-mail michi@theo3.physik.uni-stuttgart.de; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9904150.

Durga P. Choudhury, John S. Derov, and S. Sridhar, "Harmonic Generation from $YBa_2Cu_3O_{7-\delta}$ Microwave Resonators." Submitted to Appl. Phys. Lett. Department of Physics, Northeastern University, 360 Huntington Avenue, Boston, MA 02115; e-mail dpc@neu.edu; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9904080; S. Sridhar's telephone (617) 373-2930; telefax (617) 373-2943; e-mail srinivas@neu.edu.

Y.-D. Chuang, A. D. Gromko, D. S. Dessau, Y. Aiura, Y. Yamaguchi, K. Oka, A. J. Arko, J. Joyce, H. Eisaki, S. I. Uchida, K. Nakamura, and Yoichi Ando, "A Re-Examination of the Electronic Structure of $Bi_2Sr_2CaCu_2O_{8+\delta}$ and $Bi_2Sr_2Cu_1O_{6+\delta}$: An Electron-Like Fermi Surface and the Absence of Flat Bands at E_F." Submitted to Phys. Rev. Lett. Department of Physics, University of Colorado, Boulder, CO 80309-0390; D. S. Dessau's e-mail dessau@colorado.edu; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9904050.

Joshua L. Cohn, "1/8 Doping Anomalies and Oxygen Vacancies in Underdoped Superconducting Cuprates." To be published in the Proc. of the University of Miami Conf. on High Temp. Supercond. (HTS99), Miami, Fla., Jan. 7-13, 1999. Dept. of Physics, Univ. of Miami, P.O. Box 248046, Coral Gables, FL 33124; phone (305) 284-2325; fax (305) 284-4222; e-mail cohn@phyvax.ir.miami.edu; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9904116.

A. Conde-Gallardo, I. Joumard, J. Marcus, and T. Klein, "Nonlinear ac Response of the Vortex System in the Cubic $(K,Ba)BiO_3$ Superconductor." To be published in Eur. Phys. J. B. Departamento de Física, CINVESTAV-PIN, Apdo. Postal 14-740, 07360 México D.F., MEXICO; telefax (525) 747-7097; e-mail conde@fis.cinvestav.mx.

M. Cyrot, "Critical Temperature of Short Coherence Length Superconductors." Laboratoire Louis Néel, CNRS, BP 166, F-38042 Grenoble Cedex 9, FRANCE.

U. Scotti di Uccio, F. Lombardi, and F. Miletto Granozio, "Structural Properties of Single Domain (103) *YBCO* Films Grown on Buffered (110) *MgO*." Submitted to Physica C. INFM-Dipartimento di Scienze Fisiche, Università di Napoli

"Federico II," Piazzale Tecchio 80, I-80125 Napoli, ITALY; e-mail scotti@axpnal.na.infn.it.

L. Fruchter, S. T. Johnson, B. Hayani, and C. J. van der Beek, "Evidence for an Angular Dependent Contribution from Columnar Defects to the Equilibrium Magnetization of $YBa_2Cu_3O_{7-\delta}$." Submitted to Phys. Rev. B. Laboratoire de Physique des Solides, Université Paris-Sud, Bâtiment 510, F-91405 Orsay, FRANCE; S. T. Johnson's e-mail stuart@lps.u-psud.fr; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9903407.

M. Grüninger, D. van der Marel, A. A. Tsvetkov, and A. Erb, "Observation of Out-of-Phase Bilayer Plasmons in $YBa_2Cu_3O_{7-\delta}$." Solid State Physics Laboratory, University of Groningen, Nijenborgh 4, 9747 AG Groningen, THE NETHERLANDS; telephone +31 50 363 4812; telefax +31 50 363 4825; e-mail markus@phys.rug.nl; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9903352.

Ilya A. Gruzberg, Andreas W. W. Ludwig, and N. Read, "Exact Exponents for the Spin Quantum Hall Transition." Institute for Theoretical Physics, University of California, Santa Barbara, CA 93106-4030; e-mail ilya@itp.ucsb.edu; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9902063. 73.40.Hm; 73.20.Fz; 72.15.Rn.

K. C. Hewitt, N. L. Wang, J. C. Irwin, D. M. Pooke, A. E. Pantoja, and H. J. Trodahl, "On the 590 cm^{-1} B_{1g} Feature in Underdoped $Bi_2Sr_2CaCu_2O_{8+\delta}$." Submitted to Phys. Rev. B. Department of Physics, Simon Fraser University, 8888 University Drive, Burnaby, B.C., CANADA V5A 1S6; telephone (604) 291-5488; telefax (604) 291-3592; e-mail hewitta@sfu.ca; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9904029. 74.25.Gz; 74.25.Jb; 74.25.Kc; 74.62.Dh; 74.72.Hs.

Z. Homonnay, Z. Klencsár, V. Chechersky, Gy. Vankó, M. Gál, E. Kuzmann, S. Tyagi, J.-L. Peng, R. L. Greene, A. Vértes, and A. Nath, "Effect of Praseodymium on the Lattice Dynamics and Electronic Structure of the *Cu(1)-O(4)* Chain in $Y_{1-x}Pr_xBa_2Cu_3O_{7-\delta}$." To be published in Phys. Rev. B (in press). Department of Nuclear Chemistry, Eötvös Loránd U., P.O. Box 32, H-1518 Budapest, HUNGARY; phone +36 1 209 0555, ext. 1564; fax +36 1 209 0609; e-mail homonnay@para.chem.elte.hu. 74.72.Bk; 74.25.-q.

Baruch Horovitz, "Second Magnetization Peak in Flux Lattices: The Decoupling Scenario." Department of Physics, Ben-Gurion University of the Negev, Beer-Sheva 84105, ISRAEL; e-mail baruch@bgumail.bgu.ac.il; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9903167.

I. Joumard, J. Marcus, T. Klein, and R. Cubitt, "Small Angle Neutron Scattering and Magnetization Measurements in the Cubic $(K,Ba)BiO_3$ Superconductor." Submitted to Phys. Rev. Lett. Laboratoire d'Etudes des Propriétés Electroniques des Solides, Centre National de la Recherche Scientifique, B.P. 166, F-38042 Grenoble Cedex 9, FRANCE; e-mail joumard@lepes.polycnrs-gre.fr. 74.60.Ge.

V. Kagalovsky, B. Horovitz, Y. Avishai, and J. T. Chalker, "Quantum Hall Plateau Transitions in Disordered Superconductors." To be published in Phys. Rev. Lett. Department of Physics, Ben-Gurion University of the Negev, Beer-Sheva 84105, ISRAEL; B. Horovitz's e-mail baruch@bgumail.bgu.ac.il; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9812155.

G. Kallias, M. Pissas, E. Moraitakis, and D. Niarchos, "Irreversibility Line in Optimally Doped ($T_c \approx 109$ K) and Oxygen Reduced ($T_c \approx 104$ K) $Bi_{1.7}Pb_{0.3}Sr_2Ca_2Cu_3O_{10+\delta}$." To be published in Physica C (in press). Contact M. Pissas, Institute of Materials Science, National Center for Scientific Research "Demokritos," 15310 Ag. Paraskevi, Athens, GREECE; telephone +30 1 6503 306; e-mail mpissas@ims.demokritos.gr. Key words: irreversibility line, $Bi_{1.7}Pb_{0.3}Sr_2Ca_2Cu_3O_{10+\delta}$, H-T phase diagram.

W. N. Kang, B. W. Kang, Q. Y. Chen, J. Z. Wu, Y. Bai, W. K. Chu, D. K. Christen, R. Kerchner, and Sung-Ik Lee, "Triple Sign Reversal of Hall Effect in $HgBa_2CaCu_2O_{6+\delta}$ Thin Films After Heavy-Ion Irradiations." Submitted to Phys. Rev. Lett. National Creative Research Initiative Center for Superconductivity, Department of Physics, Pohang University of Science and Technology, Kyungbuk, 790-784, SOUTH KOREA; telephone +82 562 279 2713; telefax +82 562 279 3099; e-mail wnkang@postech.ac.kr; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9903427. 74.60.Ge; 72.15.Jf; 74.72.Gr.

Hisashi Kondo and Tôru Moriya, "Spin Fluctuation-Induced Superconductivity in κ-*BEDT-TTF* Compounds." Submitted to J. Phys. Soc. Jpn. Department of Physics, Faculty of Science and Technology, Science University of Tokyo, Noda 278-8510, JAPAN; e-mail a6295702@rs.noda.sut.ac.jp; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9903374. Key words: organic superconductor, spin fluctuation, Hubbard model, triangular lattice, resonance peak, nuclear spin-lattice relaxation rate.

Y. Kopelevich, S. Moehlecke, J.H.S. Torres, R. Ricardo da Silva, and P. Esquinazi, "Thermomagnetic Flux-Jump Instabilities and Second Magnetization Peak in $Bi_2Sr_2CaCu_2O_8$ High-T_c Superconducting Crystals." To be published in J. Low Temp. Phys. Instituto de Física 'Gleb Wataghin,' Universidade Estadual de Campinas (UNICAMP), 13083-970 Campinas, SP, BRAZIL; e-mail kopel@ifi.unicamp.br. 74.60.Ge; 74.60.Jg; 74.72.Hs.

Z. Kovacevic, R. Hayn, and N. M. Plakida, "Effective Hubbard Model for *Zn*-Doped CuO_2 Plane." Preprint

#E17-98-324; submitted to Eur. Phys. J. B. Joint Institute for Nuclear Research, 141980 Dubna, Moscow Region, RUSSIA.

M. Leghissa, J. Rieger, H.-W. Neumüller, J. Wiezoreck, F. Schmidt, W. Nick, P. van Hasselt, and R. Schroth, "Development of HTS Power Transmission Cables." Presented at the 1998 Appl. Supercond. Conf. (ASC), Palm Desert, Calif., Sept. 13-18, 1998. Siemens AG, Corporate Technology, D-91050 Erlangen, GERMANY.

O. V. Misochko, K. Sakai, S. Nakashima, and G. Gu, "Pairing Symmetry and Localization Probed by Electronic Raman Scattering in Disordered High-T_c Superconductors." To be published in Phys. Rev. B. Communications Research Lab, Kansai Advanced Research Center, 588-2 Iwaoka, Kobe-shi, Hyogo 651-2401, JAPAN; telephone +81 78 969 2197; telefax +81 78 969 2154; e-mail misochko@crl.go.jp or misochko@issp.ac.ru. 74.25.Gz; 74.72.Hs; 74.62.Dh.

A. Mourachkine, "The Pseudogap in $Bi_2Sr_2CaCu_2O_{8+x}$ Single Crystals from Tunneling Measurements: Possible Evidence for the Cooper Pairs Above T_c." Submitted to Europhys. Lett. Service de Physique des Solides, Université Libre de Bruxelles, CP233, Boulevard du Triomphe, B-1050 Brussels, BELGIUM; telephone +32 2 650 5751; telefax +32 2 650 5916; e-mail anmourac@ulb.ac.be; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9903395. 74.50.+r; 74.25.-q; 74.72.Hs.

D. Munzar, C. Bernhard, A. Golnik, J. Humlícek, and M. Cardona, "Anomalies of the Infrared-Active Phonons in Underdoped *YBCO* as an Evidence for the Intra-Bilayer Josephson Effect." Max-Planck-Institut für Festkörperforschung, Heisenbergstrasse 1, D-70569 Stuttgart, GERMANY; telephone +49 711 689 1744; telefax +49 711 689 1712; e-mail munzar@cardix.mpi-stuttgart.mpg.de; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9903291. 74.25.Gz; 74.72.Bk; 74.25.Kc; 74.50.+r.

Y. Nakamura, Yu. A. Pashkin, and J. S. Tsai, "Coherent Control of Macroscopic Quantum States in a Single-Cooper-Pair Box." To be published in Nature. NEC Fundamental Research Laboratories, Tsukuba, Ibaraki 305-8501, JAPAN; e-mail yasunobu@frl.cl.nec.co.jp; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9904003.

M. D. Nersesyan, J. R. Claycomb, Q. Ming, J. H. Miller, Jr., J. T. Richardson, and D. Luss, "Chemomagnetic Fields Produced by Solid Combustion Reactions." Preprint #99:026; submitted to Appl. Phys. Lett. Department of Chemical Engineering, University of Houston, Houston, TX 77204-5641; D. Luss's e-mail dluss@uh.edu; preprint also available from Texas Center for Superconductivity; telephone (713) 743-8200; telefax (713) 743-8201; e-mail preprints@www.tcs.uh.edu. 81.20.Ka; 85.25.Dq; 74.25.Ha.

M. P. Oomen, J. Rieger, M. Leghissa, B. Fischer, B. ten Haken, and T. Arndt, "Magnetic ac Loss in Twisted-Filament *Bi-2223* Tapes." Presented at the 1998 Appl. Supercond. Conf. (ASC), Palm Desert, Calif., Sept. 13-18, 1998. Siemens AG, Corporate Technology, D-91050 Erlangen, GERMANY.

M. Pinteric, S. Tomic, M. Prester, D. Drobac, O. Milat, K. Maki, D. Schweitzer, I. Heinen, and W. Strunz, "Probing the Order Parameter of the Layered Organic Superconductor κ-*(BEDT-TTF)$_2$Cu[N(CN)$_2$]Br* by ac Susceptibility Measurements." Submitted to Phys. Rev. B. Institute of Physics, University of Zagreb, P.O.B. 304, HR-10 000 Zagreb, CROATIA. 74.70.Kn; 74.25.Ha; 74.25.Bt.

M. Pissas, D. Stamopoulos, E. Moraitakis, G. Kallias, D. Niarchos, and M. Charalambous, "Magnetic Relaxation Measurements in the Region of the Second Magnetization Peak in an $HgBa_2CuO_{4+\delta}$ Single Crystal." To be published in Phys. Rev. B. Institute of Materials Science, National Center for Scientific Research "Demokritos," 15310 Ag. Paraskevi, Athens, GREECE; telephone +30 1 6503 306; e-mail mpissas@ims.demokritos.gr.

A. K. Pradhan, S. Shibata, K. Nakao, and N. Koshizuka, "Flux Lattice Melting in Twinned $NdBa_2Cu_3O_{7-y}$ Single Crystals." To be published in Europhys. Lett. (in press). Superconductivity Research Laboratory, International Superconductivity Technology Center (ISTEC), 10-13 Shinonome 1-chome, Koto-ku, Tokyo 135-0062, JAPAN; telefax +81 3 3536-5714 or -5717; e-mail pradhan@istec.or.jp. 74.60.Ge; 74.60.Jg; 74.25.Fy.

E. Sudhakar Reddy, "Microstructural Studies of Melt Processed Y_2BaCuO_5." To be published in J. Mater. Res. Department of Superconductivity, University of Tokyo, Hongo 7-3-1, Bunkyo-ku, Tokyo 113-8656, JAPAN; fax +81 3 5689 0574; e-mail esr@grex.cyberspace.org. Key words: melt processing, Y_2BaCuO_5, pro-peritectic phase, platelets, domains.

E. Sudhakar Reddy, T. Murakami, Y. Nakayama, J. Shimoyama, and K. Kishio, "Melt Processing and Microstructural Studies of $HgBa_2CuO_y$." Submitted to Physica C. Department of Superconductivity, University of Tokyo, Hongo 7-3-1, Bunkyo-ku, Tokyo 113-8656, JAPAN; telefax +81 3 5689 0574; e-mail esr@grex.cyberspace.org. Key words: $HgBa_2CuO_y$, Ba_2CuO_3, melt processing, peritectic reaction, microstructure, domains, platelets.

E. Sudhakar Reddy, K. D. Otzschi, J. Shimoyama, and K. Kishio, "On the Intermediate Peak in Melt Textured $YBa_2Cu_3O_y$ Superconductors." Submitted to Phys. Rev. B. Department of Superconductivity, University of Tokyo, Hongo 7-3-1, Bunkyo-ku, Tokyo 113-8656, JAPAN; telefax +81 3 5689 0574; e-mail esr@grex.cyberspace.org.

Key words: melt texturing, peak effect, intermediate peak, matching peak effect, critical current density, $YBa_2Cu_3O_y$.

S. Reich and Y. Tsabba, "Possible Nucleation of a 2D Superconducting Phase on WO_3 Single Crystals Surface Doped with Na^+." To be published in Eur. Phys. J. B. Department of Materials and Interfaces, Weizmann Institute of Science, Rehovot 76100, ISRAEL; telefax +972 8 9344138; e-mail cpreich@weizmann.weizmann.ac.il. 74.70.-b; 74.20.-z; 74.60.Ec.

Sergei A. Sergeenkov, "Piezomagnetism and Stress Induced Paramagnetic Meissner Effect in Mechanically Loaded High-T_c Granular Superconductors." Bogoliubov Laboratory of Theoretical Physics, Joint Institute for Nuclear Research, 141980 Dubna, Moscow Region, RUSSIA; e-mail ssa@thsun1.jinr.ru; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9903393. 74.50.+r; 74.62.Fj; 74.80.Bj; 75.80.+q.

B. Sriram Shastry, "Superconductivity from Repulsion: A Variational View." Submitted to J. Phys. A Lett. Department of Physics, Indian Institute of Science, Bangalore 560 012, INDIA; telephone +91 80 309 2865; telefax +91 80 346 1602; e-mail bss@physics.iisc.ernet.in; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9903343.

D. L. Sisson, S. G. Doettinger, A. Kapitulnik, R. Liang, D. A. Bonn, and W. N. Hardy, "Specific Heat of *Zn*-Doped $YBa_2Cu_3O_{6.95}$: Possible Evidence for Kondo Screening in the Superconducting State." Department of Applied Physics and Physics, Stanford University, Stanford, CA 94305-4090; A. Kapitulnik's telephone (415) 723-3847; telefax (415) 725-2189; e-mail ak@loki.stanford.edu; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9904131. 74.25.Bt; 74.62.Dh; 75.20.Hr.

A. W. Smith, H. M. Jaeger, T. F. Rosenbaum, W. K. Kwok, and G. W. Crabtree, "Signature of the Matching Field in Bose-Glass Melting of Untwinned $YBa_2Cu_3O_{7-\delta}$ Single Crystals." Department of Physics, James Franck Institute, University of Chicago, Chicago, IL 60637; preprint also available from Janice Coble, Materials Science Division, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL 60439; telephone (630) 252-5497; telefax (630) 252-9595; e-mail coble@anl.gov.

Artur Sowa, "Nonlinear Maxwell Theory and Electrons in Two Dimensions." Department of Mathematics, Yale University, 10 Hillhouse Avenue, New Haven, CT 06520; e-mail sowa@math.yale.edu; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9904204. 03.50.Kk; 73.20.Dx.

D. Stamopoulos, M. Pissas, E. Moraitakis, G. Kallias, D. Niarchos, M. Charalambous, "Magnetic Phase Diagram in a $HgBa_2CuO_{4+\delta}$ Single Crystal." To be published in Physica C (in press). Contact M. Pissas, Institute of Materials Science, National Center for Scientific Research "Demokritos," 15310 Ag. Paraskevi, Athens, GREECE; phone +30 1 6503 306; e-mail mpissas@ims.demokritos.gr. Key words: magnetic, $HgBa_2CuO_{4+\delta}$, hysteresis.

T. Timusk, "Infrared Properties of Exotic Superconductors." To be published in Physica C: Proc. of the First Crete Euroconference on Anomalous Complex Superconductors (ACS-1), Heraklion, Greece, Sept. 25-Oct. 2, 1998. Department of Physics and Astronomy, McMaster University, Hamilton, Ontario, CANADA L8S 4M1; e-mail timusk@mcmaster.ca; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9903254.

Tom Timusk and Bryan Statt, "The Pseudogap in High-Temperature Superconductors: An Experimental Survey." To be published in Rep. Prog. Phys., Vol. 62. Department of Physics and Astronomy, McMaster University, Hamilton, Ontario, CANADA L8S 4M1; e-mail timusk@mcmaster.ca.

J. M. Tranquada, "Experimental Evidence for Topological Doping in the Cuprates." To be published in the Proc. of the University of Miami Conf. on High Temp. Supercond. (HTS99), Miami, Fla., Jan. 7-13, 1999. Department of Physics, Brookhaven National Laboratory, Upton, NY 11973-5000; e-mail jtran@bnl.gov; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9903458.

J. M. Tranquada, N. Ichikawa, K. Kakurai, and S. Uchida, "Charge Segregation and Antiferromagnetism in High-T_c Superconductors." To be published in J. Phys. Chem. Solids: Proc. of Frontiers in Neutron Scattering Research, ISSP, University of Tokyo, JAPAN, Nov. 24-27, 1998. Department of Physics, Brookhaven National Laboratory, Upton, NY 11973-5000; e-mail jtran@bnl.gov; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9903453. Key words: superconductors, neutron scattering, charge-density waves, spin-density waves.

S. O. Valenzuela, G. A. Jorge, and E. Rodríguez, "Measuring the Interaction Force Between a High Temperature Superconductor and a Permanent Magnet." To be published in Am. J. Phys. Laboratorio de Bajas Temperaturas, Departamento de Física, Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Buenos Aires, Ciudad Universitaria, Pabellón I, 1428 Buenos Aires, ARGENTINA; e-mail sov@df.uba.ar. 01.50.Pa; 74.60.Ge; 74.60.Ec; 74.80.Bj.

I. Vekhter and A. Houghton, "Quasiparticle Thermal Conductivity in the Vortex State of High-T_c Cuprates." Department of Physics, University of Guelph, Guelph, Ontario, CANADA N1G 2W1; e-mail vekhter@anik.physics.uoguelph.ca; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9904077. 74.25.Fy; 74.72.-h; 74.60.-w.

T. Venkatesan, R. P. Sharma, Y. G. Zhao, Z. Y. Chen, C. H. Lee, W. L. Cao, J. J. Li, H. D. Drew, S. B. Ogale, R. Ramesh, M. Rajeswari, T. Wu, I. Jin, S. Choopun, M. Johnson, W. K. Chu, and G. Baskaran, "Superconducting Cuprates and Magnetoresistive Manganites: Similarities and Contrasts." Preprint #99:022; submitted to the Proc. of the 7th NEC Symp.; to be published in Mater. Sci. Eng. B. Texas Center for Superconductivity, University of Houston, Houston, TX 77204-5932; telephone (713) 743-8200; telefax (713) 743-8201; e-mail preprints@www.tcs.uh.edu.

Jian-Xin Zhu and C. S. Ting, "Proximity Effect, Quasiparticle Transport, and Local Magnetic Moment in Ferromagnet-d-Wave Superconductor Junctions." Department of Physics and Texas Center for Superconductivity, University of Houston, Houston, TX 77204-4792; telephone (713) 743-8276; telefax (713) 743-8201; e-mail jxzhu@mira.tcs.uh.edu. 74.20.Mn; 74.80.Fp; 74.50.+r.

F. Zuo, J. S. Brooks, Ross H. McKenzie, J. A. Schlueter, and Jack M. Williams, "Paramagnetic Limiting of the Upper Critical Field of the Layered Organic Superconductor κ-*(BEDT-TTF)$_2$Cu(SCN)$_2$*." Department of Physics, University of Miami, Coral Gables, FL 33124; telephone (305) 284-2323; telefax (305) 284-4222; e-mail zuo@physics.miami.edu; preprint also available at http://xxx.lanl.gov/abs/cond-mat/9904186.

F. Zuo, J. Hagel, S. Wanka, J. Wosnitza, E. Balthes, D. Schweitzer, and W. Strunz, "Interlayer Dissipation in Magnetic Fields for H||J in κ-*(ET)$_2$I$_3$*." Department of Physics, University of Miami, Coral Gables, FL 33124; telephone (305) 284-2323; telefax (305) 284-4222; e-mail zuo@physics.miami.edu. Key words: organic superconductors, Josephson coupling, interlayer magnetoresistance. 74.25.Fy; 74.50.+r; 74.70.Kn.

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.)*

July 12, 1999: Cryogenic Society of America Short Course Symposium – Helium Cryogenics: Liquid and Gas, Montreal Convention Centre, Montréal, Québec, Canada. CSA has been invited by the CEC/ICMC Board to put on a full-day program to complement the scholarly papers presented later in the week. Symposium aimed towards anyone working in the cryogenics field, with information presented by experts on many phases of helium cryogenics. **Registration fee, $145 (before June 1, 1999); $165 (after June 1, 1999).** For more information, contact Laurie Huget, Executive Director, Cryogenic Society of America, 1033 South Blvd., Suite 13, Oak Park IL 60302; telephone (708) 383-6220; telefax (708) 383-9337; e-mail csa@huget.com; or visit the CSA Web site at http://www-csa.fnal.gov/csa_bin/shortcourse99.html.

**July 12 - 16, 1999:* Cryogenic Engineering Conference & International Cryogenic Materials Conference (CEC/ICMC), Palais de Congrès, Montréal, Quebec, Canada. The CEC focuses on the science and engineering required for cryogenic applications such as liquefied gases for fuels; space applications of cryogenic liquids; cooling and performance of superconducting magnet systems in medical, transportation, power, and basic research applications. Will also cover systems, machinery, control technology, and thermodynamics required to produce low temperatures. The ICMC focuses on the development, characterization, fabrication, and optimization of the materials used in cryogenic applications, typically broken into two broad categories – structural materials and superconducting materials. ICMC contributions cover both high- and low-temperature superconducting materials from basic materials research through behavior of composite cables and wires in applications. Cryogenic structural materials cover a broad range including nonmetallic composites, polymeric resins, and insulation materials; ferrous alloys; nickel-base alloys; aluminum alloys; and specialized materials for advanced cryocooler applications. For information, contact Centennial Conferences, Suite A-112, 4800 Baseline Road, Boulder, CO 80303; telephone (303) 499-2299; telefax (303) 499-2599; e-mail centennial@orci.com; Web site http://www.cec-icmc.org.

July 26 - 28, 1999: The 1999 DOE Annual Peer Review Meeting, Loews L'Enfant Plaza Hotel, Washington, DC. For more information, contact Zia Haq at Energetics, Inc.; telephone (202) 479-2748/115; telefax (202) 479-0154; e-mail zhaq@energeticsinc.com.

**Aug. 1 - 3, 1999:* Symposium on Micro- and Nanocryogenics (MNC), University of Jyvaskyla, Jyvaskyla, Finland. Satellite to the LT-22 Conference in Helsinki, Finland (Aug. 4-11, 1999). Will focus on the growing field of cryogenic applications of micro- and nanometer size systems. Topics of the symposium include: micro-refrigeration, thermometry, microbolometers and other space applications, SQUIDs and their applications, and other cryogenic applications of micro- and nanostructures. Limited to about 100 persons. For further information, contact Minna Ranta (MNC), Department of Physics, University of Jyvaskyla, P.O. Box 35 (Y5), FIN-40351 Jyvaskyla, Finland; telephone +358 14 602354; telefax +358 14 602351; e-mail mnc@phys.jyu.fi. Or contact Jukka Pekola (Conference Chair) at Jukka.Pekola@phys.jyu.fi, or Antti Manninen (Co-Chair) at Antti.Manninen@phys.jyu.fi. Also see the MNC Web page at http://www.phys.jyu.fi/jyflweb/latest/mnc.html.

**Aug. 12 - 15, 1999:* Electron Transport in Mesoscopic Systems, Chalmers University of Technology

and Göteborg University, Göteborg Sweden. Satellite to the LT-22 Conference in Helsinki, Finland (Aug. 4-11, 1999). The five main topics are: single charge tunneling, Andreev reflections and proximity effects in S/N structures, transport in quantum dots and wires, time-dependent transport in mesoscopic structures, and superconducting nanocircuits. Format is expected to be two sessions for each main topic with a rapporteur starting the first session (giving an introduction to the topic, the recent progress in the field, and the outstanding problems to be solved with possible projections) and an invited speaker starting the other one. Three additional oral contributions and time for extended discussions planned. **Abstract deadline, May 1, 1999.** Attendance limited to about 200 persons. For information, contact Tord Claeson, Conference Chair, Department of Physics, Chalmers University of Technology, S-41296 Göteborg, Sweden; e-mail f4atc@fy.chalmers.se; Web site http://fy.chalmers.se/meso_satellite/index.html.

Sept. 18 - 24, 1999: First Euroconference on Vortex Matter in Superconductors, Aghia Pelagia, Crete, Greece. Topics will include nanoengineered pinning arrays – regular and disordered, vortex visualization, vortex matter at extreme conditions, vortices in mesoscopic superconductors, Josephson vortices, vortex dynamics, driven vortex lattices, melting, vortices in superfluids, plasma, etc. Limited to 120 participants. **Abstract deadline, May 31, 1999; registration deadline, June 30, 1999.** For more information, see the Web page or contact Dr. V. V. Moshchalkov, Katholieke Universiteit Leuven, Laboratorium voor Vaste-Stoffysica en Magnetisme, Celestijnenlaan 200 D, B-3001 Leuven (Heverlee), Belgium; telephone +32 16 327618; telefax +32 16 327983; e-mail Victor.Moshchalkov@fys.kuleuven.ac.be; Web site http://www.fys.kuleuven.ac.be/vortex/.

Nov. 29 - Dec. 3, 1999: Materials Research Society Fall 1999 Meeting: Symposium II – Superconducting Materials – Properties, Crystal Chemistry, and Processing, Boston, Mass. Symposium will investigate the relationship between features at atomic level and macroscopic physical properties. This multidisciplinary symposium hopes to provide an interactive forum for stimulating discussion and information exchange. Papers are solicited to emphasize the following, but are not limited to: structure, processing, and property relations; crystal chemistry; defects, microstructures, and characterization; dopants, impurities, and nonstoichiometry; grain boundaries and interfaces; phase equilibria and thermodynamics; kinetics and phase evolution; crystallography (structure, modulation, and texturing); processing; bulk (tapes and wires); films (fundamental growth studies and coated conductors); crystal growth; physical properties (transport and flux pinning); new materials (including non-oxides); and prototype devices. Joint sessions anticipated with Symposia L: Fundamental Mechanisms of Low-Energy-Beam Modified Surface Growth and Processing, and O: Substrate Engineering – Paving the Way to Epitaxy. A tutorial titled Crystal Chemistry of High-Temperature Superconductors is tentatively planned. Abstract submission opens, May 17, 1999. **Abstract deadlines, June 7, 1999 (paper, fax, and e-mail submissions); June 21, 1999 (Web submissions).** For information on Symposium II, contact Winnie Wong-Ng, A256 MATLS, Ceramic Division, National Institute of Standards and Technology, Gaithersburg, MD 20899; telephone (301) 975-5791; telefax (301) 975-5334; e-mail winnie.wong-ng@nist.gov. For abstract submission information, contact Materials Research Society, 506 Keystone Drive, Warrendale, PA 15086-7573; telephone (724) 779-3003; telefax (724) 779-8313; Web site http://www.mrs.org/meetings/fall99/.

RESOURCES

Information

New Book: *Superconductivity: Current Topics*, by S. L. Kakani. Book links the science with engineering aspects, and aims to synchronize various relevant disciplines in physics, chemistry, materials science, and engineering. Topics are: introduction to the experimental and theoretical background to both low- and high-T_c superconductivity, summary and current status of high-T_c superconductors, pairing mechanisms and review of some proposed novel mechanisms, extensive review of experimental and theoretical status of fullerene superconductivity, and current and future applications. Publ. 1999; 450 pp.; ISBN 81-7230-124-3. Contact Sumer Jain, Arihant Publishing House, 5 Opp. Rajasthan University, Jawahar Lal Nehru Marg, Jaipur 302 004, India.

New Books: *Superconductor Technology – Applications to Microelectro-optics, Electrical Machines, and Propulsion Systems,* by A. R. Jha. Book provides comprehensive coverage of both theory and applications, and integrates research efforts from around the world. Covers LTS and HTS superconductors. Publ. 1998; 328 pp.; price $84.95; ISBN 0-471-17775-X.

Introduction to Superconducing Circuits, by Alan M. Kadin. Makes superconductivity more accessible by using simple circuit models to develop an understanding of the physics of superconductors. Principles are then applied to the practical areas of superconducting circuits and systems, including cutting-edge circuit applications and materials. Publ. 1999; 408 pp.; price $89.95; ISBN 0-471-31432.

Contact John Wiley & Sons, Inc., Department 713, 1 Wiley Drive, Somerset, NJ 08875-1272; telephone (800) 225-5945 or (732) 469-4400; telefax (732) 302-2300.

AMES LABORATORY

Dr. Sreeparna Mitra
A219 Physics
Ames Laboratory
Iowa State University
Ames, Iowa 50011-3020

High-T_c Update is published for the Office of Basic Energy Sciences, U.S. Department of Energy, under Contract W-7405-eng-82 with the Ames Laboratory, Iowa State University. Support is also provided by organizations listed on the masthead and by other donors. Please direct all inquiries to:

Dr. Sreeparna Mitra
A219 Physics
Ames Laboratory
Iowa State University
Ames, Iowa 50011-3020
Telephone: (515) 294-3877
Telefax: (515) 294-1134
E-mail: MITRA@AMESLAB.GOV
MITRA@IASTATE.EDU

Project Director and Editor: Sreeparna Mitra
Science Editor: John R. Clem
ISSN 1048-1141
Homepage: http://www.iitap.iastate.edu/htcu/htcu.html

High-T_c Update is the high-T_c superconductivity information exchange newsletter. It is available twice-monthly as hard copy and as electronic mail. Please send: 1) preprints, reprints, and other T_c-related reports or publications; 2) descriptions of on-going work; 3) meeting news; and 4) etc. Information in *High-T_c Update* is intended for limited distribution. Readers are expected to respect the rights of authors.