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NOTA BENE:

The *High-T_c Update* Web site (http://www.iitap.iastate.edu/htcu/htcu.html) is currently receiving an average of 25,000 visits per month from browsers from more than 70 different countries! In response to inquiries from corporations about possible links from the highly visible *High-T_c Update* Web page as a way to introduce their products and services, we have recently decided to solicit Web sponsors. Information about the sponsorships are available online through our Web site. Please consider helping *High-T_c Update* in these tough financial times while increasing your institution's visibility with a large diverse group of scientists and managers. (See charts on page 13). Contact the editor if you have any questions.

Physics Tomorrow essay-contest winner Paul Grant (EPRI) presents a humorous futuristic look at progress in high-T_c superconductivity research in the year 2028, describing the discovery of "Little's Elixir," a computationally designed polymer with T_c greater than 600 K and structural properties similar to DNA! See *Physics Today* **51**, No. 5 (May 1998).

The possibility of superconductivity above 250 K in $Tl_{1.8}Ba_{2.0}Ca_{2.6}Cu_3O_{10+\delta}$ at high pressure, as indicated by sharp resistance changes versus temperature at 4.3 GPa, is reported by C. Y. Han et al., *Fizika Nizkikh Temperatur* **24**, 305 (1998). Readers should be aware, however, that this finding has yet to be verified by other groups.

Vortices

A new electron-beam-scanning technique for the imaging of singly quantized vortices in type-II superconductors with a resolution of 1-2 μm has been developed by J. Martin (Tübingen) et al. Using superconducting $Nb/AlO_x/Nb$ junctions at 1.6 K, the authors imaged Abrikosov vortices oriented perpendicular to the barrier plane but trapped in a superconducting tunnel junction. The voltage signal $\delta V(x,y)$ of the current-biased junction was recorded as a function of the beam coordinates (x,y). The top *Nb* electrode was covered with an SiO_2 film of 300 nm thickness, absorbing most of the 5 keV beam energy. The authors explain the signal generating the image using a model in which beam-induced electronic excitations in the SiO_2 overlay film are trapped in the local magnetic field protruding from a vortex, resulting in a locally increased recombination rate.

The specific heat of a high-purity, twinned crystal of $DyBa_2Cu_3O_{7.00}$ (T_c = 90.16 K) grown in a $BaZrO_3$ crucible has been measured by B. Revaz et al. (Genève) in magnetic fields **B**||c and **B**⊥c up to 16 T. The authors observed first-order-like specific-heat peaks on the vortex-lattice melting line from ~6T to 16 T (**B**||c) with an entropy jump of 0.5±0.1 k_B/vortex/layer. The fields B_m and peak temperatures T_m were found to obey the relation $B_m(T_m) = (139\ T)(1 - T_m/T_c)^{1.33}$. The measured anisotropy factor of the effective masses was $\gamma = (m_c/m_{ab})^{1/2} = 5.3\pm0.5$. These results agree well with those for nonmagnetic, twinned $YBa_2Cu_3O_{7.00}$.

Torque magnetometry is a powerful method for measuring the superconducting anisotropy γ in the mixed state. As pointed out by M. Willemin (Zürich and IBM-Zurich) et al., in order to use the three-dimensional anisotropic London model to analyze torque data, the vortex lattice must be in a reversible state, which normally is restricted to a narrow range close to the upper critical field $H_{c2}(T)$ because of large pinning effects that set in at lower temperatures T. The authors found that applying an additional oscillating magnetic field perpendicular to the main field B leads to a fast depinning of the vortex lattice. This vortex-shaking process dramatically extends the reversible domain in the (H,T) phase diagram, and hence the range over which torque investigations can be made.

A numerical study of the statics and dynamics of a model three-dimensional vortex lattice at low magnetic fields has been carried out by S. Ryu and D. Stroud (Ohio State). At low fields, the authors find a weakly first-order phase transition at T_m, at which the vortex lattice melts into a line liquid. Phase coherence parallel to the field persists until a sharp crossover, conceivably a phase transition, at $T_\ell > T_m$, which develops an infinite vortex tangle. The authors find that while the magnetization jump coincides with the first-order transition in the dense limit, the jump in the low-density regime originates from the screening effect of thermally generated vortex loops and does not necessarily coincide with the melting transition of the vortex lattice. The authors thus suggest that some experimental puzzles in the low-density regime (less than about 1 T for $YBa_2Cu_3O_{7-\delta}$ or 10 mT for $Bi_2Sr_2CaCu_2O_{8+\delta}$) may be resolved in terms of a vortex-loop unbinding picture.

The crossing point of the magnetization versus temperature appearing below T_c in highly anisotropic superconducting cuprates has been measured by J. Mosqueira (Universidad de Santiago de Compostela) et al. in various compounds with different numbers N of closely spaced superconducting CuO_2 layers per periodicity length s and different values of s. By correcting the measurements with different extrinsic inhomogeneity effects through the Meissner fraction, the authors demonstrate that in the high-magnetic-field limit the intrinsic crossing point may be explained at a quantitative level using the theory of Z. Tesanovic et al. [*Phys. Rev. Lett.* **69**, 3563 (1992)] based on thermal fluctuations of 2D pancake vortices with an effective periodicity length s, independent of N.

The response of a vortex core in a layered superconductor to ac electromagnetic fields with frequencies $\omega \leq 2\Delta/\hbar$ has been calculated by M. Eschrig (Northwestern) et al. The authors find that in this frequency range the response is dominated by order-parameter collective modes that are coupled to the vortex-core bound states of Caroli, de Gennes, and Matricon. The authors find that the vortex core has a more complex and richer dynamics than predicted by previous theories. The ac field drives an oscillating, nearly homogeneous supercurrent in the direction of the electric field, superimposed upon a dissipative current flow, which has a dipolar spatial structure. The order parameter response at low frequencies is an approximately rigid collective motion of the vortex structure perpendicular to the external field, but this structure becomes strongly deformed at frequencies of order $\omega \geq 0.5\Delta/\hbar$.

The dynamic vortex mass has been calculated by N. B. Kopnin (Landau Institute and Argonne) and V. M. Vinokur (Argonne) for clean Fermi superfluids, including both s- and d-wave superconductors, as a response to vortex acceleration. Expressing the vortex mass as a tensor, the authors show that the diagonal component dominates in the extremely clean limit of long quasiparticle mean free time, while the off-diagonal mass dominates in the moderately clean regime.

Two papers by P. Ao and X.-M. Zhu (Umeå) discuss the core-state contribution to the viscous drag coefficient η for a vortex moving in a type-II superconductor. The authors find that in the dirty limit, the core contribution saturates to a value determined by the Fermi energy and the order parameter, independent of the normal-state resistivity.

An experimental study by J. E. Berger (Brown) et al. of the peak effect in weakly disordered 2H-$NbSe_2$ favors a description in which the peak effect arises from a crossover between the Larkin pinning length and a rapidly falling elastic length in a vortex phase populated with thermally excited defects. A study of the thickness dependence of the peak effect at varying driving currents suggests that both screw and edge dislocations are involved in the vortex-lattice disordering.

$RBa_2Cu_3O_{7-\delta}$

A preprint by A. Erb (Genève) et al. reports on the use of three different and complementary measurements (magnetization, positron annihilation, and NMR) providing evidence that the formation of oxygen-vacancy clusters is the origin of the fishtail anomaly in $YBa_2Cu_3O_{7-\delta}$ *(Y-123).* While the anomaly is intrinsically absent in $YBa_2Cu_3O_{7.0}$, it also can be suppressed in the optimally doped state ($YBa_2Cu_3O_{6.92}$), where vacancies are present. The authors thus conclude that single vacancies or point defects cannot be responsible for the fishtail anomaly, but that clusters of oxygen vacancies are the origin of this effect.

Raman measurements by M. Käll (Chalmers University of Technology and Risø) et al. in $YBa_2Cu_3O_x$ (x = 6.72-6.82) reveal intense phonon scattering due to an electronic resonance localized near oxygen vacancies in the *CuO* chains. Below room temperature, the resonance can be photo-bleached in a manner similar to reported persistent photo-induced superconductivity effects, indicating photon-assisted oxygen ordering or electron vacancy capture. By comparing Raman and x-ray diffraction data, the authors established a correlation between the stability of the photo-induced state and the oxygen-ordering kinetics in the *CuO* chains.

Compton scattering, i.e., inelastic x-ray scattering with very high momentum and energy transfer, is a probe of the ground-state, one-electron properties of a solid. A. Shukla (ESRF-Grenoble) et al. have used this technique to compare the electron momentum density in $PrBa_2Cu_3O_{7-\delta}$ and $YBa_2Cu_3O_{7-\delta}$, since $PrBa_2Cu_3O_{7-\delta}$ is almost always insulating and $YBa_2Cu_3O_{7-\delta}$ is (for small δ) always superconducting. The electron momentum densities in the two materials were found to differ in a striking way, in contrast to LDA-based calculations, which predict similar behavior for both. The authors conclude that disorder in the form of *Pr* substitutions on *Ba* sites is responsible for the observed effects. Using a combined strategy to minimize substitution disorder and avoid tetravalent *Pr* on the *Ba* site, the authors have succeeded (details of this work to be published elsewhere) in obtaining small flux-grown crystallites of $PrBa_2Cu_3O_{7-\delta}$ with a T_c of 90 K and a bulk Meissner effect. The oxygenation used for these samples was the same as for 90 K superconducting $YBa_2Cu_3O_{7-\delta}$, suggesting that the doping is optimal for both *PBCO* and *YBCO.* When big enough samples of superconducting $PrBa_2Cu_3O_{7-\delta}$ become available, the authors expect that the oxygen ordering behavior and the electron momentum density will be similar to that in $YBa_2Cu_3O_{7-\delta}$.

As reported by S. P. Athur (TCSUH) et al., conventional sintering in air does not seem to be a suitable process for producing the *123* phase in $YbBa_2Cu_3O_{7-\delta}$ *(Yb-123).* On the other hand, the authors found that a simple sintering process under a reduced oxygen partial pressure could be used to prepare nearly phase-pure *Yb-123*.

The pseudo-binary phase diagram between $NdBa_2Cu_3O_x$ and $Ba_3Cu_{10}O_{13}$, and the nucleation and growth of $NdBa_2Cu_3O_x$ in air have been observed by D. K. Aswal (Shizuoka) et al. *in-situ* using high-temperature optical microscopy. The authors found that interface kinetics is the rate-limiting factor in the crystallization of *Nd-123* crystals from high-temperature solutions, while solute diffusion is the rate-limiting factor in *Nd-123* crystallization from a peritectic melt.

Bi Cuprates

As noted by W. Goldacker et al. (Forschungszentrum Karlsruhe), hysteresis losses and coupling losses, a main component of the ac losses in *Bi-2223* tapes, can be reduced by enhancing the resistivity of the matrix material between the filaments and applying a filament twist. By alloying the *Ag* sheath with *Au,* the resistivity of the *Ag* sheath can be raised, but only by a factor of less than ten at 77 K. For this reason, the authors have used resistive $SrCO_3$ barriers between *Ag*-sheathed *Bi-2223* monocores to achieve a greater enhancement of the transverse resistivity. The authors note that $SrCO_3$ is a cheap, fine-grained, commercially available material, which withstands tape annealing, bonds well to *Ag,* and does not react with the superconductor.

A related paper by H. Eckelmann (Forschungszentrum Karlsruhe) et al. reports on the ac loss properties of 37-filament *Bi-2223* tapes with a *AgAu*(8wt%) matrix and 19-filament tapes with $SrCO_3$ barriers between the filaments. The authors report transport ac loss and magnetic ac loss measurements in parallel and perpendicular magnetic fields. Both kinds of tapes were also prepared with filament twists with a pitch less than 20 mm. In magnetic ac loss measurements, reduced ac losses due to decoupled filaments were observed for the twisted tapes with a resistive matrix in low parallel fields.

A preprint by M. R. Koblischka (Oslo) et al. reports magnetization measurements in a model structure, which exhibits a low-field peak in the magnetization at positive fields in decreasing external magnetic field, similar to the behavior that has been observed in *Bi-2223* tapes.

The powder-in-tube method, which involves industrial processes such as wire drawing and rolling, has been widely used to fabricate *Ag*-clad *Bi-2223* tapes. A. N. Iyer (TCSUH) et al. report on experiments in which, instead of wire drawing, the silver billet was reduced in size by groove rolling. Improved current transport properties were found, which the authors attribute to the increase in the amount and texturing of *2223* grains and to the absence of microcracks.

A preprint by M. Lelovic (Pittsburgh) et al. reports on the properties of a *Ag*-sheathed *Bi-2223* tape on which a $YBa_2Cu_3O_{7-\delta}$ *(Y-123)* thin film was deposited. Although the *Y-123* film had a $T_c \approx 72$ K and a broad transition region, the critical current density of the coated tape was higher than that of an uncoated tape at 20 K, 40 K, and 60 K in fields above about 2 kOe.

The properties of isothermal melt-processed *Bi-2212/Ag* tapes containing *MgO* and Al_2O_3 additions are reported by N. V. Vo et al. (Los Alamos). Critical current densities at 4 K in excess of 10^5 A/cm^2 were obtained in tapes melt-processed below 800°C.

$La_{2-x}Sr_xCuO_4$

The out-of-plane magnetoresistance of single crystals of $La_{2-x}Sr_xCuO_4$ has been measured by N. E. Hussey (Cambridge) et al. over a wide doping range ($0.09 \le x \le 0.25$) with the field applied parallel and perpendicular to the CuO_2 planes. The results suggest that the c-axis transport in $La_{2-x}Sr_xCuO_4$ is an incoherent process whereby the carriers undergo significant scattering within the plane before hopping to an adjacent layer.

Thin Films

A detailed study of the tunneling spectra of bicrystal grain-boundary junctions fabricated from the high-temperature superconductors (HTS) $YBa_2Cu_3O_{7-\delta}$ *(YBCO),* Bi_2Sr_2Ca-$Cu_2O_{8+\delta}$ *(Bi-2212),* $La_{1.85}Sr_{0.15}CuO_4$ *(LSCO),* and $Nd_{1.85}Ce_{0.15}CuO_{4-y}$ *(NCCO)* has been carried out by L. Alff (Köln) et al. In all experiments the tunneling direction was along the CuO_2 planes. With the exception of *NCCO,* for all materials a pronounced zero-bias conductance peak (ZBCP) was observed, which decreases with increasing temperature and disappears at the critical temperature. The authors explain these results by the presence of a dominating d-wave symmetry of the order parameter, resulting in the formation of zero-energy Andreev bound states at surfaces and interfaces of HTS. The absence of a ZBCP for *NCCO* is consistent with a dominating s-wave symmetry of the pair potential in this material. The observed nonlinear shift of spectral weight to finite energies under a magnetic field is in qualitative agreement with recent theoretical predictions.

A variational formulation and an efficient numerical method have been derived by L. Prigozhin (Weizmann Institute and Ben-Gurion University) to determine the current-density and magnetic-field distributions and hysteretic magnetization curves for thin films in the critical state. The author uses this method to solve problems for various film shapes with either the Bean (J_c = constant) or Kim [$J_c(B) = J_c(0)/(1 + |B|/B_0)$] model for $J_c(B)$.

The processing of *YBCO* films by decomposition of metal-trifluoroacetate precursors, and its application to the development of coated conductors has been investigated by S. Sathyamurthy and K. Salama (TCSUH). Pole-figure analysis of films deposited on (100) $SrTiO_3$ and $LaAlO_3$ single-crystal substrates showed that these films have a high degree of alignment with the substrate both out-of-plane (<0.5°) and in-plane (<1.5°). These chemically derived films were also found to have critical current densities well above 5×10^5 A/cm^2 at 77 K for 0.5 μm thick films.

The design and testing of a new device for point-contact tunneling measurements in superconductors are described in a preprint by L. Ozyuzer (Argonne and IIT) et al. The insert is designed for use with a continuous flow cryostat which allows for a large range of sample temperatures from 1.5 K to room temperature. The use of nonmagnetic parts allows tunneling measurements to be performed in high magnetic fields.

Applications

High-temperature superconducting (HTS) single-flux-quantum (SFQ) digital circuit applications will require high-resistance HTS Josephson junctions. B. D. Hunt et al. (Northrop Grumman) have investigated the factors affecting the resistance of SNS edge junctions that use *Co*-doped *YBCO* as the normal-metal layer. The authors found that edge angle, base-electrode material, and deposition conditions of the normal metal and counterelectrode all have an effect on device resistance. Controlling these factors has enabled the fabrication of high-quality, high-resistance (≈1 Ω) SNS edge junctions with one-σ I_c spreads down to 10% and with critical currents and I_cR_n products suitable for SFQ digital applications.

Improved structural and dielectric properties of nonlinear dielectric $SrTiO_3$ thin films on $LaAlO_3$ substrates have been accomplished by Q. X. Jia (Los Alamos) et al. by incorporating a homo-epitaxial $LaAlO_3$ interlayer between the substrate and the dielectric film. With this interlayer, the quality factor of $SrTiO_3$ films with superconducting $YBa_2Cu_3O_{7-\delta}$ electrodes on $LaAlO_3$ substrates was improved by more than 50% at 4.2 GHz and 4 K. This improvement, combined with no change in nonlinearity, led to greater than a 50% enhancement of finesse factor (defined as the product of the quality factor and the fractional shift in the resonant frequency) for coplanar waveguide microwave resonators. The improvement was attributed to the reduced planar defect density in the $SrTiO_3$ films as seen by transmission electron microscopy.

Theory

Analytic results for the polarizabilities $\chi(\mathbf{Q},\omega)$ in the charge, spin, and current channels have been derived by H.-Y. Kee (Rutgers and Bell Labs) and C. M. Varma (Bell Labs) for two-dimensional s- and d-wave superconductors for large momentum transfer. The authors predict a collective mode in the charge channel for extremum vectors of the Fermi surface with energy below twice the maximum superconducting gap. Such modes are directly observable through inelastic x-ray or electron scattering. Scattering of single-particle excitations by these collective modes leads to several unusual features in the single-particle spectrum in the superconducting state which are seen in angle-resolved photoemission experiments.

The high-temperature series for the momentum distribution function n_k of the 2D t-J model has been calculated by W. O. Putikka (Cincinnati and Ohio State) et al. to twelfth order in the inverse temperature. By extrapolating the series to T = 0.2 J, the authors searched for a Fermi surface of the 2D t-J model. They found that three criteria for estimating the location of a Fermi surface violate Luttinger's theorem, implying that the t-J model does not have an adiabatic connection to a noninteracting model.

A mechanism for superconductivity suppression in stripe-correlated cuprates, based on pinning of the stripes by impurities such as *Zn,* is proposed by A. H. Castro Neto (UC-Riverside) and A. V. Balatsky (Los Alamos). The superfluid density is suppressed in the vicinity of the impurity because of the low-dimensional character of superfluid carriers on the stripes. The authors predict a critical impurity concentration $z_c \sim T_c^2$ and a linear T_c suppression by *Zn* doping.

The tunneling dynamics of dopant-induced hole polarons that are self-localized by electron-phonon coupling in a two-dimensional antiferromagnet have been studied by K. Yonemitsu (IMS, Okazaki) et al. The authors' treatment is based on a path-integral formulation of the adiabatic

(Born-Oppenheimer) approximation, combined with many-body, tight-binding, instanton, constrained lattice dynamics, and many-body exact diagonalization techniques. The authors discuss the implications of their results for the doping-dependent isotope effect, pseudogap, and T_c of a superconducting polaron pair condensate, and they compare their results with observed properties of the high-T_c cuprates.

Using the scenario of a hybridized mixture of localized bipolarons and conduction electrons, J. Ranninger (Grenoble) and A. Romano (Salerno) demonstrate the simultaneous appearance of a pseudogap and strong incoherent contributions to the quasiparticle spectrum arising from phonon shake-off effects. This can be traced back to temporarily fluctuating local lattice deformations, giving rise to a double peak in the pair distribution function, which should be a key feature in testing the origin of the incoherent contributions recently seen in angle-resolved photoemission spectroscopy (ARPES).

The nonadiabatic electron-phonon corrections for superconducting pairing have been investigated by A. Perali et al. (Roma) for a specific tight-binding model corresponding to a 2D square lattice. The authors are thus able to investigate the role of various specific properties such as band filling, nesting effects, and a realistic Van Hove singularity on the superconducting effective pairing beyond Migdal's limit.

A preprint by P. Miller (Georgetown) et al. reports calculations of the effects of vertex corrections, a non-constant density of states, and a self-consistently determined phonon self-energy for the Holstein model on a 3D cubic lattice. The authors replace vertex corrections with a Coulomb pseudopotential μ^*, adjusted to give the same T_c, and repeat the calculations to see which effects are a distinct feature of vertex corrections. While vertex corrections can cause significant changes in many properties (critical temperatures, isotope coefficients, superconducting gaps, free-energy differences, and thermodynamic critical fields), the changes can usually be well modeled by an appropriate Coulomb pseudopotential. The isotope coefficient, however, proves to be the quantity that most clearly shows effects of vertex corrections that cannot be mimicked by a μ•.

The superconducting transition in the attractive Hubbard model in two dimensions has been studied by J. R. Engelbrecht and A. Nazarenko (Boston) using the self-consistent T-matrix approximation. The authors demonstrate that for large system sizes, this approximate method produces XY critical scaling in the correlation length and pair susceptibility. For the parameters investigated, the critical regime is quite large, extending beyond five times T_{KTB}. The authors suggest that vortex-pair unbinding in the normal state may be relevant to pseudogap behavior in the underdoped cuprates.

As shown by M. Casas (Palma de Mallorca) et al., a simple model of a boson-fermion mixture of unpaired fermions plus linear-dispersion-relation Cooper pairs including pair-breaking effects leads to Bose-Einstein condensation for all dimensions greater than unity. The Bose-Einstein critical temperatures are substantially greater than those of the BCS theory of superconductivity for the same BCS model interaction between the fermions.

To examine the mixed s±id pairing state of high-T_c superconductors, S. Sergeenkov (JINR-Dubna) calculated the differential thermopower ΔS of an SND junction in the presence of strong charge-imbalance effects (due to a difference between the quasiparticle μ_q and Cooper-pair μ_p chemical potentials) using the generalized Ginzburg-Landau theory for a homogeneous admixture of s-wave and d-wave superconductors near T_c. The calculated thermopower was found to strongly depend on the relative phase $\theta = \phi_s - \phi_d$ between the two superconductors, exhibiting a pronounced maximum near the mixed s±id state with $\theta = \pm\pi/2$.

The dynamic response to external currents of periodic arrays of Josephson junctions in a resistively and capacitively shunted junction model has been studied by F. Gibbons (Northeastern) et al. including full capacitance-matrix effects. The authors introduce three different models for the capacitance matrix and calculate the corresponding I-V characteristics for dc + ac currents. For two of the models, the authors find giant capacitive fractional steps in the I-V's, strongly dependent on the amount of screening involved. The authors show that these steps are not related to vortex oscillations but to localized screened phase locking of a few rows in the lattice.

The effect of thermal fluctuations on the behavior of a four-terminal SQUID has been investigated by R. de Bruyn Ouboter (Leiden) and A. N. Omelyanchouk (Kharkov). For some combinations of the control parameters, the four-terminal SQUID is in a bistable state with two magnetic flux values. The authors study switching between the two flux values by thermal noise or an applied transport current.

Time-reversal-violating processes in a p-wave superconductor have been analyzed by J. Goryo and K. Ishikawa (Hokkaido). The Landau-Ginzburg effective action has an induced T-violating term, which causes a mixing between the electric field and the magnetic field. The authors find that several T-violating electromagnetic phenomena are caused by this term, such as an unusual Meissner effect, a Hall effect without a magnetic field, and Faraday rotation without a magnetic field.

Other Activities

As shown by J. B. Kycia et al. (Northwestern), the superconducting transition temperature of high-quality single crystals of UPt_3 can be varied systematically by annealing, revealing that the intrinsic transition temperature of UPt_3 is 563±5 mK. The suppression of the superconducting transition by defects is consistent with a modified Abrikosov-Gor'kov formula that includes anisotropic pairing, Fermi-surface anisotropy, and anisotropic scattering by defects.

The dynamical dielectric response of a one-dimensional, correlated insulator has been determined by R. Neudert (Dresden) et al. via electron energy-loss spectroscopy on Sr_2CuO_3 single crystals. Magnetic susceptibility measurements previously have shown that Sr_2CuO_3 can be regarded as an almost ideal realization of the 1D spin-1/2 antiferromagnetic Heisenberg model, which describes the magnetic excitations of a Mott-Hubbard insulator. The authors found that the observed momentum and energy dependence of the low-energy features, which correspond to collective transitions across the gap, are well described by an extended one-band Hubbard model with moderate nearest-neighbor Coulomb interaction strength. An exciton-like peak appears with increasing momentum transfer. The authors stress that these observations provide experimental evidence for spin-charge separation in the relevant excitations of this compound, as theoretically expected for the one-dimensional Hubbard model.

The response of a superconducting $Pb_{0.82}In_{0.18}$ slab to time-dependent steps in a parallel applied field has been investigated by H. Vasseur et al. (École Normale Supérieure). The authors found that the penetration of magnetic flux into the sample is impeded by surface pinning, but there are practically no observable effects of bulk pinning.

Overview

A review of NMR and NQR spectroscopies in the high-temperature superconductors (chiefly $La_{2-x}Sr_xCuO_4$, $YBa_2Cu_3O_{6+x}$, and $YBa_2Cu_4O_8$), emphasizing the differences in behavior relative to metals and conventional superconductors, has been prepared by A. Rigamonti et al. (Pavia). The authors also review NMR-NQR spectra and relaxation rates in two-dimensional quantum antiferromagnets (particularly La_2CuO_4) driven towards the superconducting state by charge doping. They discuss behavior in the normal state, including spin-gap opening and superconducting fluctuations, and they review information that has been obtained about the vortex lattice and flux-line dynamics from NMR line narrowing, T_1, and echo dephasing (334 refs.).

Thesis

A B.S. thesis by S. J. Smullin (Brown) reports an experimental study of the peak effect in 2H-$NbSe_2$. The author found that thermally activated motion and dimensional crossover do not explain the physics of the vortex lattice in the peak region. However, collective pinning theory was found to describe the data at low fields, and the peak effect was found to occur within the predicted melting regime (34 refs.).

Contributed by John R. Clem

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COMING EVENTS

*(An * indicates a previously listed event.)*

**June 24 - 26, 1998:* 40th Electronic Materials Conference of the TMS, Charlottesville, Va. Sponsored by the Electronic Materials Committee of The Minerals, Metals & Materials Society (TMS), University of Virginia, Charlottesville, Va. The conference will provide a forum for topics of current interest and significance in the areas related to the preparation and characterization of electronic materials. Individuals actively engaged or interested in electronic materials research and development are encouraged to attend this meeting. For further information, contact The Minerals, Metals & Materials Society, 420 Commonwealth Drive, Warrendale, PA 15086;

telephone (724) 776-9000; telefax (724) 776-3770; Web site http://www.tms.org/meetings/specialty/emc98/emc98.html.

*June 29 - July 10, 1998:

1998 Summer Course on Superconducting Materials – Advances in Technology and Applications, CNR Conference Centre, Bologna, Italy. Will focus on both HTS and LTS superconducting materials. Fundamental aspects, theory, and advances in materials synthesis, processing, and properties will be featured as well as current developments in superconducting components and devices. Particular emphasis will be placed on existing and potential applications of HTS superconductors. In addition to the official lectures, several seminars will be held by invited scientists. Director of Summer Course: K. Kitazawa (University of Tokyo, Japan). Course is open to all participants; however, attendance will be limited to about 70 students. Topics include HTS materials history and perspectives; chemical and structural aspects of superconducting phases; new classes of superconductors; physical properties and mechanisms of superconducting materials; dissipative properties and ac losses; synthesis methodologies; bulk materials and thick films; thin films and multilayers; tapes and wires; relationships between process parameters and functional properties; main characterization techniques for materials and performances; medical applications; large-scale applications such as energy production, magnets, motors, magnetic energy storage, accelerator technology, and space applications; and small-scale applications including passive (microwave resonators and filters) and active devices (Josephson junctions and circuits, detectors, and sensors). For further information, contact Anna Tampieri, Scientific secretary, IRTEC-CNR, via Granarolo 64, I-48018 Faenza, Italy; telephone +39 546 699 757; telefax +39 546 46 381; e-mail superconductors@ irtec1.irtec.bo.cnr.it; Web site http://area.bo.cnr.it/ldavinci.

July 20 - 22, 1998:

1998 DOE Superconductivity Program Annual Peer Review, Loews L'Enfant Plaza Hotel, Washington, DC. Will consist of concurrent sessions evaluating HTS wire and systems projects being undertaken at six national laboratories. Open to the public. Panels of experts will provide scores and written comments. An additional workshop will be held after the review on July 22, to discuss the suitability of existing cryogenic systems for HTS electric power equipment as commercialization gets closer. For more info call Audrey Lamanna at Energetics, Inc.; telephone (202) 479-2748; e-mail alamanna@energeticsinc.com.

*Sept. 14 - 25, 1998:

NATO Advanced Study Institute – Material Science, Fundamental Properties and Future Electronic Applications of High-T_C Supercondutors, Albena, Bulgaria. Purpose is to help young physicists in their initial research in the field of HTS and related topics, and to support creation of the atmosphere of collaboration between physicists from NATO and Cooperative Partner countries. Aimed at scientists at the postdoctoral level with an appropriate scientific background. Subjects include: electronic structure of novel superconductors and related materials, Fermi surface mapping by angle-resolved photoemission, d-wave superconductivity, application of Eliashberg theory, and anomalous normal-state properties of HTS. Special attention will be paid to classical problems in the physics of superconductivity: Ginzburg-Landau and London theories and their application to theory of plasma waves in superconducting systems, surface phase transitions, hydrodynamic relations for superconductors, dynamics and pinning of vortices in HTS, electrodynamics, magnetic susceptibility, optical properties, tunneling, and fluctuation phenomena in superconductors. Will also include phenomenology of superconductivity: practical applications, superconducting field effect transistors, electric field effects in superconductors, and grain boundary and other material effects. **Application deadline, June 15, 1998.** For information, contact T. Mishonov, Department of Theoretical Physics, Faculty of Physics, University of Sofia, 5, J. Bourchier Blvd., 1164 Sofia, Bulgaria; telephone +359 2 256 652; telefax +359 2 96 252 76; e-mail mishonov@ rose.phys.uni-sofia.bg. **Note new application deadline.**

Jan. 7 - 13, 1999:

1999 University of Miami Conference on High Temperature Superconductivity, Miami, Fla. Third in the series. Goal of this conference is to provide a forum for engaging researchers in a focused dialog directed at exploring and distilling the latest experimental and theoretical results in the field likely to have significant influence on the understanding of the normal-state properties and origin of superconductivity in this class of materials. The format will involve a relatively small number (150) of researchers assembled in common sessions. The conference, in addition to addressing physical properties, microscopic theory, and mechanisms for high-temperature superconductivity, will include other related topics (e.g. ladders, manganites, and nickelates). Partial list of topics for which abstracts are solicited includes: pseudogap, stripes/AF correlations, gap symmetry/tunneling, vortex properties, electronic structure, photoemission, non-Fermi liquids, mechanisms, new materials, other oxides (*Mn, Ni,* etc.), and ladder compounds. **Abstract deadline, October 2, 1998.** Contributed presentations will primarily be in the form of posters, although a small number may be selected for oral presentation. For information contact HTS99@ physics.miami.edu. Further details are available on the world-wide web at http://www.miami.edu/physics/hts99.

Aug. 4 - 11, 1999:

22nd International Conference on Low Temperature Physics (LT22), Espoo and Helsinki, Finland. Topics will include: quantum gases, fluids and solids; superconductivity; magnetism and lattice properties; quantum electron transport; applications; materials; and techniques. For information, contact Conference Service Bureau, TSG-Congress Ltd., Kaisaniemenkatu 3 B 31, FIN-00100 Helsinki, Finland; telephone +358 9 628044; telefax +358 9 667675; e-mail info@tsgcongress.fi. For technical information, contact the LT22 Office, Low Temperature Laboratory, Helsinki University of Technology, P.O. Box 2200, FIN-02015 HUT; telephone +358 9 451 2962; telefax +358 9 451 2969; e-mail info@LT22.hut.fi.

RESOURCES

Information

New Book: *Superconductivity,* by John Boyd Ketterson and Shengian Song. Text focuses on the underlying theory of superconductivity. First part of the book, which treats phenomenological theories, is suitable for students with an undergraduate degree in physics. Parts II and III, which make use of second quantization, are suitable for students who have completed a year of graduate school. Aimed at students and researchers in the field wishing to have a deeper understanding of the theory of superconductivity. Part I covers London, Pippard, and Ginzburg-Landau theories; Part II discusses the BCS theory; and Part III treats nonuniform superconductors using the Bogoliubov-de Gennes approach. Publ. 1998; 425 pp.; price $68 (hardcover) or $27.97 (paperback); ISBN 0-521-56295-3 (HC) or 0-521-56562-6 (PB). Contact Customer Service Department, Cambridge University Press, 110 Midland Avenue, Port Chester, NY 10573; telephone (800) 872-7423; telefax (914) 937-4712; e-mail orders@cup.org; Web site http://www.cup.org.

Products and Services

High-quality *Bi-2223* tapes produced by the powder-in-tube method are available from BICC Cables. The Cryobicc™ tapes are fabricated in a wide range of properties and can be adjusted to meet specific customer requirements. For information, contact BICC Cables Limited, Wrexham Technology Centre, Superconductivity Group, Wrexham, Wales LL13 9XP, United Kingdom; telephone +44 1978 662518; telefax +44 1978 662464; e-mail cryobicc@bicc.co.uk.

FYI

(High-T_c Update takes no responsibility for want ads listed in this section.)

Positions Open: The Superconductivity Group of BICC Cables, a commercial supplier of *Bi-2223* tapes that also undertakes R&D in HTS products, including current leads, coils, and cable systems, seeks to fill the following positions:

Senior Scientist/Engineer: An experienced person to be responsible for the technical development of HTS tapes and devices and assist with their commercialization. The ideal candidate for this post will have a Ph.D. and several years' experience in either the materials, engineering, or physics aspects of *BSCCO* and will have a working knowledge of others. This will have been gained in an international context at renowned academic or industrial institutions and will have led to several publications in reputable scientific journals. Candidates will have a proven ability to communicate effectively in English and a second language would be an advantage. Candidates will also be able to demonstrate excellent interpersonal skills and will already possess project management and team leadership skills or have the potential to rapidly acquire them.

Materials Scientist: The post includes leading the development of our *Bi-2223* tape technology and designing solutions to suit our customers' needs. The ideal candidate for this post will have gained a Ph.D. or have post-doctoral experience in the processing of *Bi-2223* tapes or a closely related field. A hands-on attitude is required as well as the ability to work as part of a team. Candidates will display a good command of English or show the willingness to learn the language. A good publication record is desirable or the ability to establish one should be demonstrated.

Mechanical Engineer: The successful candidate will design, build and test products for mechanical, electrical, and thermal properties. He or she will liaise with the senior scientists responsible for product development and will also assist with customers' inquiries. Another important aspect of the job concerns developing new cabling machines and helping to maintain and improve the Group's extensive existing plant. The ideal candidate will already have, or be soon expected to complete, a mechanical engineering degree or equivalent level. A hands-on approach is essential, as well as the ability to work as part of a team. The Group has a commitment to innovation and will expect the successful candidate to show a flexible attitude to project work. Candidates will also be expected to have a working knowledge of cryogenic systems. Some experience of vacuum systems and Autocad is preferable but not essential.

All three posts are based in the North-West of England. The positions are permanent. BICC Cables offers a competitive salary and comprehensive benefits. All positions are available immediately and candidates are encouraged to send a cover letter and CV (Word for Windows 6.0 if possible) to Luc Le Lay, BICC Cables Limited, Energy Technology, WREXHAM LL13 9XP, United Kingdom; telephone +44 1978 66 2600; telefax +44 1978 66 2464; e-mail uclelay@bicc.co.uk.

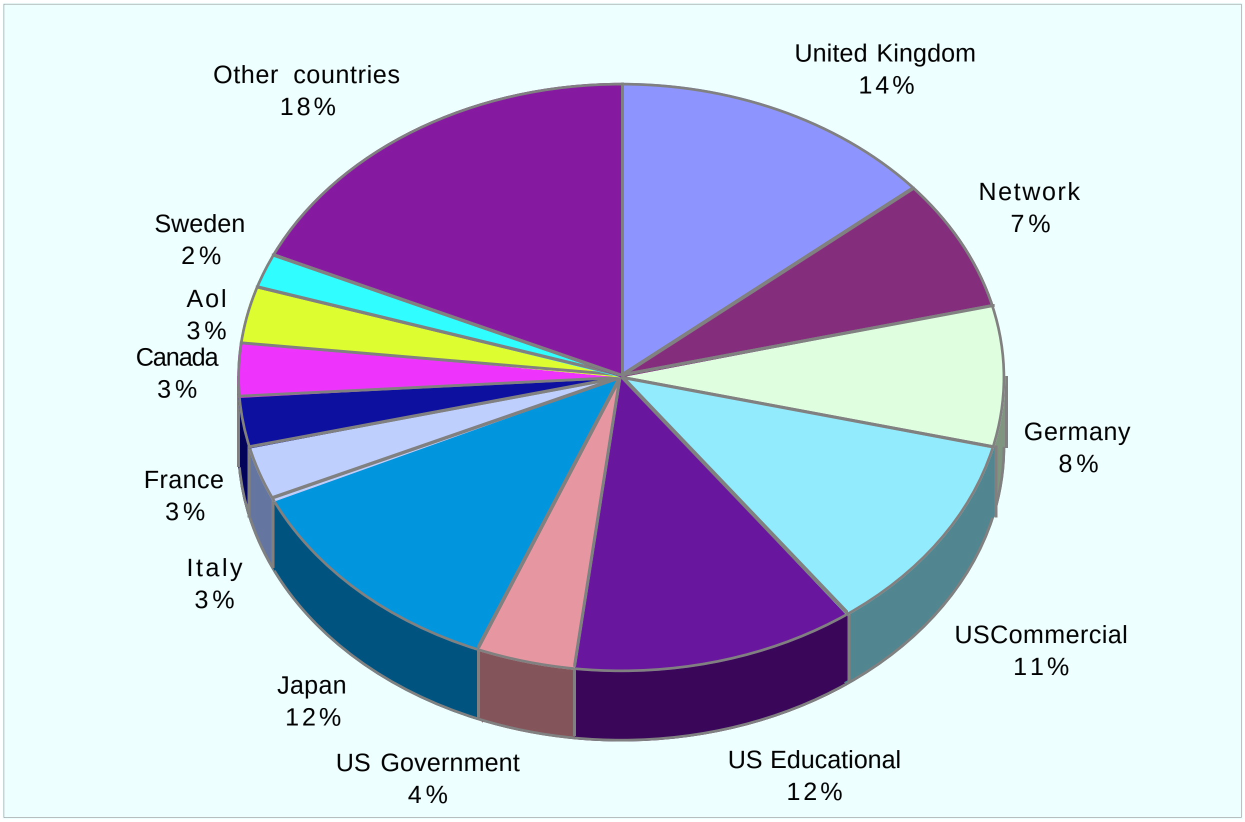

Fig. 1. Figure shows access to the High-T_c Update Web pages by domain type. Only countries with access levels of more than 420 per month are displayed on the chart. The "Other Countries" category includes visits from 60 other nations.

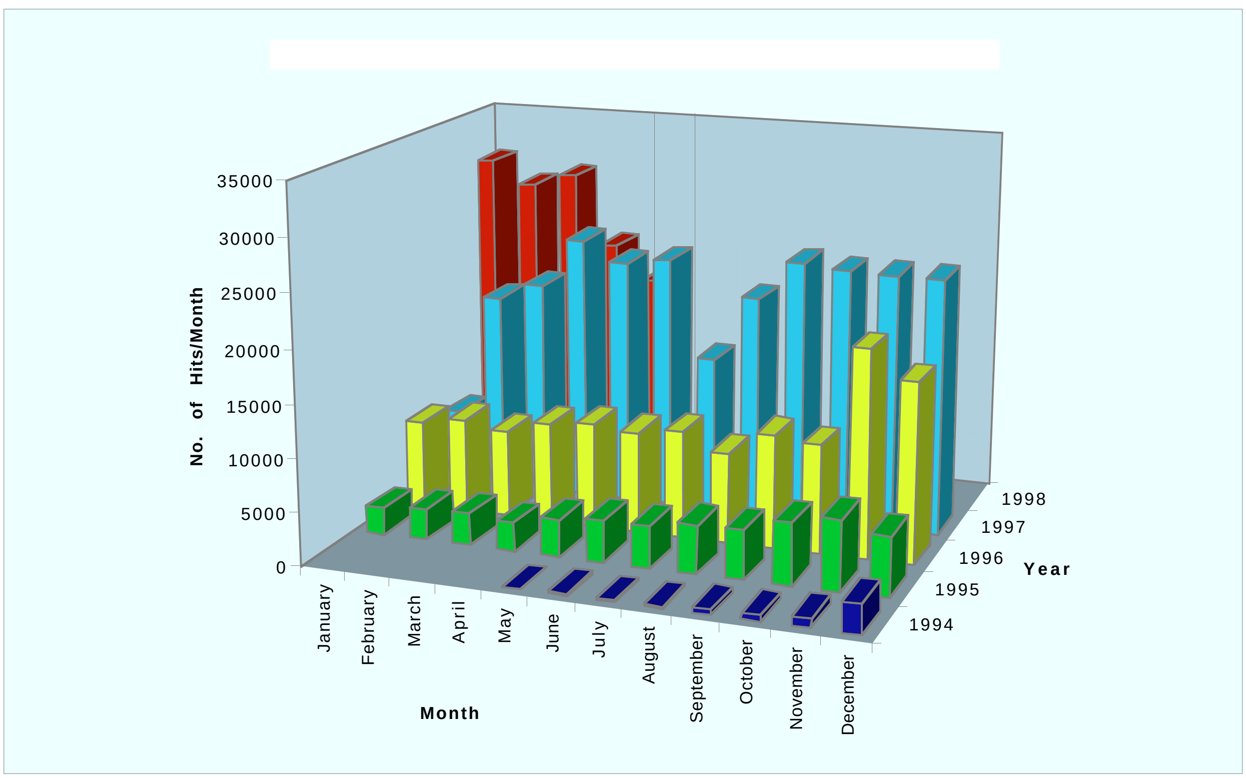

Fig. 2. Data showing the sharp increase in the number of visits to High-T_c Update Web pages over the past four years.

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ADDRESS CORRECTION REQUESTED

1ST CLASS

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