for elastic scattering, and find that a non-monotonic gap gives rise to several specific features in optical and Raman response functions. We argue that all these features are present in the experimental data on $Nd_{2-x}Ce_xCuO_4$ and $Pr_{2-x}Ce_xCuO_4$ compounds.

Invited Talk TT 33.3 Thu 14:45 H 0104

Superconductivity in the Hubbard model and the two gap energy scales in high-temperature superconductors — •Markus Aichhorn[1], Enrico Arrigoni[2], Michael Potthoff[3], Zhong Bing Huang[4], and Werner Hanke[1] — [1]Institut für Theoretische Physik und Astrophysik, Universität Würzburg — [2]Institut für Theoretische Physik und Computational Physics, Technische Universität Graz — [3]I. Institut für Theoretische Physik, Universität Hamburg — [4]Department of Physics, Hubei University, Wuhan, China

Quite after the discovery of high-temperature superconductivity in the cuprate compounds, it has been proposed that the essential physics of these materials is captured by the Hubbard model. Although this model is conceptually very simple, an exact solution is not known for more than one spatial dimension. Thus, approximate or numerical evaluations are needed for these quasi 2D materials. Our understanding of the ground-state properties of the 2D Hubbard model has improved a lot due to the development of the dynamical mean-field theory and its cluster extension. We will discuss recent results obtained by the variational cluster approach (VCA), focusing on the symmetry-broken phases at zero temperature. Besides the discussion of the competition between antiferromagnetism and d-wave superconductivity at low hole doping, we will focus on the doping evolution of the superconducting gap. We show that the Hubbard model is indeed able to describe the experimentally found two energy scales in the underdoped cuprates, and give a possible explanation of this feature in terms of a spin-fluctuation-mediated pairing mechanism.

15 min. break

TT 33.4 Thu 15:30 H 0104

Momentum-resolved electron-phonon coupling and self-energy effects in $YBa_2Cu_3O_7$: an LDA study — •Rolf Heid[1], Klaus-Peter Bohnen[1], Roland Zeyher[2], and Dirk Manske[2] — [1]Forschungszentrum Karlsruhe, Institut für Festkörperphysik — [2]Max-Planck-Institut für Festkörperforschung, Stuttgart

The observation of kinks in the electronic dispersion of high-T_c cuprates by angle resolved photoemission experiments has revived the discussion about the importance of electron-phonon interaction in the cuprates. Here we determine the effect of the electron-phonon coupling on the electronic self-energy in the normal state within the local-density approximation. Using a realistic phonon spectrum we determine the momentum and frequency dependence of $\alpha^2F(\mathbf{k},\omega)$ in $YBa_2Cu_3O_7$ for the bonding, antibonding, and chain band. We find that the maximum in the real part of the self-energy at low frequencies is about a factor 5 too small compared to the experiment. The renormalization factor $Z(\mathbf{k},\omega)$, which determines the change in the slope of the electronic dispersion due to the interaction, varies smoothly as a function of frequency and momentum. These findings show that, at least within the LDA, phonons cannot produce well-pronounced kinks in $YBa_2Cu_3O_7$.

TT 33.5 Thu 15:55 H 0104

The phonon buckling mode in $YBa_2Cu_3O_{6+x}$ measured by inelastic neutron scattering — •Markus Raichle[1], Dmitry Reznik[2], Mohammed Bakr[1], Vladimir Hinkov[1], Klaudia Hradil[3], Daniel Lamago[2], Clemens Ulrich[1], Markus Bröll[1], Philippe Bourges[2], Yvan Sidis[2], Chengtian Lin[1], and Bernhard Keimer[1] — [1]MPI für Festkörperforschung, Stuttgart, Germany — [2]Laboratoire Léon Brillouin, Paris, France — [3]Universität Göttingen, Göttingen, Germany

Cuk et al. [Phys. Rev. Lett. 93, 117003 (2004)] and Devereaux et al. [Phys. Rev. Lett. 93, 117004 (2004)] relate the antinoidal kink in ARPES measurements with the B1g phonon buckling mode. However, this assumption is controversial as this kink has also been related to the magnetic resonance mode by Kaminski et al. [Phys. Rev. Lett. 86, 1070 (2001)] and Kim et al. [Phys. Rev. Lett. 91, 167002 (2003)]. Until now inelastic neutron scattering measurements on this phonon mode on $YBa_2Cu_3O_{6+x}$ by Reznik et al. [Phys. Rev. Lett. 75, 2396 (1995)] has only been done on twinned samples for x=1. Here we present high resolution neutron measurements on the buckling mode on YBCO for x=0.6 and x=1.0. These measurements performed at Puma and 1T1 at Saclay have been made on fully detwinned samples. Thus we could show that this phonon mode performes an anisotropic superconductivity-induced interaction with a neighboring phonon mode. Hence these measurements enrich the experimental evidence for superconductivity induced phonon effects in high temperature superconductors.

TT 33.6 Thu 16:10 H 0104

d-wave stripes in cuprates: Valence bond order coexisting with nodal quasiparticles — •Matthias Vojta — Institut für Theoretische Physik, Universität Köln, 50937 Köln, Germany

We point out that unidirectional bond-centered charge-density-wave states in cuprates involve electronic order in both s- and d-wave channels, with non-local Coulomb repulsion suppressing the s-wave component. The resulting bond-charge-density wave, coexisting with superconductivity, is compatible with momentum-space features seen in recent photoemission and tunneling data and as well as in neutron-scattering measurements, once long-range order is destroyed by slow fluctuations or glassy disorder.

TT 33.7 Thu 16:35 H 0104

Charge order in $La_{1.8-x}Eu_{0.2}Sr_xCuO_4$ studied by resonant soft X-ray diffraction — •J. Fink[1,2], E. Weschke[3], E. Schierle[3], J. Geck[4], H. Hawthorn[4], H. Widati[4], H.-H. Hu[5], H. Dürr[1], B. Büchner[2], and G. A. Sawatzky[4] — [1]BESSY, Albert-Einstein-Strasse 15, 12489 Berlin — [2]IFW Dresden — [3]Hahn-Meitner-Institut Berlin — [4]UBC Vancouver, Canada — [5]II. Physikalisches Institut, Universität Köln

Stripe-like phases in hole-doped cuprates, in which antiferromagnetic domains are separated by periodically spaced domain walls to which the charge carriers are segregated, are caused by a complex interplay between lattice defects and charge and spin degrees of freedom. In $La_{1.8-x}Eu_{0.2}Sr_xCuO_4$ a stripe-like phase replaces almost the entire superconducting phase because in this system stripes are stabilized by the existence of a low-temperature tetragonal phase in a large concentration range. In order to directly prove the existence of charge ordering in these compounds we have used resonant soft X-ray scattering at the O1s and Cu2p edges. Long-range charge order exists at low temperatures and x close to 1/8. At higher temperatures and for x = 0.15 the coherence length is reduced due to fluctuations and/or a reduced order.

TT 33.8 Thu 16:50 H 0104

q-dependence of the giant bond-stretching phonon anomaly in the stripe compound $La_{1.48}Nd_{0.4}Sr_{0.12}CuO_4$ measured by IXS — •Daniel Lamago[1,2], Dmitry Reznik[2], T. Fukuda[3], K. Yamada[4], and A.Q.R. Baron[4] — [1]CEA Saclay, 91191 Gif Sur Yvette, France — [2]Forschungszentrum Karlsruhe, 76021 Karlsruhe, Germany — [3]Synchrotron Radiation Research Unit, Japan Atomic Energy Agency (Spring 8), Sayo, Hyogo 679-5148, Japan — [4]Materials Dynamics Laboratory, Harima RIKEN, 1-1-1 Kouto, Sayo, Hyogo, 679-5148 Japan

Inelastic x-ray scattering (IXS) was used to study the Cu-O bond-stretching vibrations in the static stripe phase compound $La_{1.48}Nd_{0.4}Sr_{0.12}CuO_4$. It was found that the intrinsic width in Q-space of the previously reported huge anomalous phonon softening and broadening is approximately 0.08 r.l.u. HWHM. A detailed comparison was also made to inelastic neutron scattering (INS) studies, which reported a two-peak lineshape with a "normal" and an "anomalous" phonon peaks. The "normal" branch in the neutron data seems to be mostly suppressed in the high resolution IXS data. Otherwise the agreement between the INS and the IXS was excellent.

TT 33.9 Thu 17:05 H 0104

Charge ordering phenomena and superconductivity in cuprates — •Leonardo Tassini, Bernhard Muschler, Wolfgang Prestel, Rudi Hackl, Michael Lambacher, and Andreas Erb — Walther-Meissner-Institut, 85748 Garching, Germany

The relationship between charge ordering phenomena and superconductivity was investigated with electronic Raman scattering in $La_{2-x}Sr_xCuO_4$ (LSCO) and $Y_{1-y}Ca_yBa_2Cu_3O_{6+x}$ (Y-123) single crystals. New low-energy excitations were found that are interpreted in terms of dynamical stripes. Below the onset point of superconductivity p_{sc1} the stripes are oriented along the diagonal of the CuO_2 planes for both LSCO and Y-123. The Raman data indicate that diagonal stripes compete with superconductivity. Apparently, stripes along the