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Neutron scattering studies on lanthanum cuprates (invited) (abstract)

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The results of recent inelastic neutron scattering investigations of the magnetic excitations in La_2CuO_4 are reviewed. Experiments were performed using a wide range of incident neutron energies. Our study of the paramagnetic phase is consistent with a picture for the magnetic dynamics which shows conventional spin waves at higher energies and an overdamped response due to spin-wave interactions at lower energies. The evolution of the magnetic dynamics with doping in the $\text{La}_{2-x}(\text{Ba,Sr})_x\text{CuO}_4$ system is discussed.

Hole dynamics in the copper oxide planes (invited) (abstract)

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The physics of a hole doped into the Mott insulating state of the CuO_2 planes is studied in a large variational space. The hole quasiparticle that forms is quite different from a free electron by virtue of the cloud of spin flips (with respect to the background antiferromagnet) that it carries with it. The momentum dependence of the quasiparticle energy is unusual: $\epsilon(\mathbf{k})$ is lowest at nonzero momentum, and has an anisotropic dispersion. At finite doping, the quasiparticles are assumed to fill the rigid band described by the single-hole $\epsilon(\mathbf{k})$, forming a weakly interacting Fermi gas. Normal state properties of the high-temperature superconducting oxides, such as $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$, are calculated in the relaxation time approximation. Good agreement with experiment is obtained for the magnetic susceptibility, Hall coefficient, thermopower, specific heat, and plasma frequency as a function of both doping x and temperature.¹

Work supported by the U.S. Department of Energy.

¹S. A. Trugman, Phys. Rev. Lett. **65**, 500 (1990).