and fluorescence micrographs of each stage would allow one to verify that the series of micrographs shown in figure 2, a through f, are of the same cell. As shown, the cell in figure 2d has a different orientation from that of the cell in figure 2, e and f.

Finally, it should be pointed out that the micrograph in figure 1f described in the figure legend as a PtK cell appeared in a previous publication (*3*, figure 2b) described as an L_6 myoblast. This discrepancy requires explanation.

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Antiferromagnetic Exchange Energies in Planar Cuprates

The Cu-Cu superexchange constant is a critical parameter in our understanding of the high T_c superconductors. Goddard and his co-workers reported a cluster calculation (*1*) which yields an exchange constant (*2*) J = 410 K within the cuprate planes. In their reply (*3*) to a recent criticism (*4*) of the T_c calculation, they continued to state that no experimental determination of J exists, and they have disputed our assignment (*5*) of the B_{1g} light-scattering feature near 3100 cm^{-1} in La_2CuO_4 to spin-pair excitations. Here we point out the errors in both statements by Goddard's group.

We first summarize the experimental situation, which was largely ignored in (*1*) and (*3*). In the case of K_2NiF_4, the prototypical system for such studies, the light-scattering results (*6*) for spin-pair (or magnon-pair) scattering agree in quantitative detail both with theoretical expectations (*7*) and with neutron scattering data (*8*). Both experiments yield $J = 115 \pm 1$ K. It is therefore well established that analysis of light-scattering spectra provides a reliable measure of J, contrary to the assertion in (*3*).

The simplest cuprate material, La_2CuO_4, is isomorphic to K_2NiF_4, but with spin ½ Cu sites rather than spin 1 Ni. For La_2CuO_4, early neutron-scattering results (*9*) set a lower limit on J of 600 K. These results were also ignored in (*1*) and (*3*). Our light-scattering spectra (*5*) have demonstrated the presence of a peak at 3100 cm^{-1} in La_2CuO_4 which obeys the anticipated selection rules. For spin ½ the theoretical situation is more complex, but a model which includes quantum fluctuations (*10*) shows that the simplest interpretation (*5*) of the B_{1g} spectra in fact yields a value of J within a few percent of the correct value. The new calculation (*10*) agrees quantitatively with the positions and spectral shapes of all the components observed. The simple theory (*7*) yields the value (*5*) 1480 K, while a fit to the quantitative calculation of Singh *et al.* (*10*) yields J = 1540 K. Subsequent published neutron-scattering work (*11*) has increased the lower bound on J to ~1000 K, while the most recent data (*12*) show a resolved peak that yields J = 1620 K. The neutron scattering probes long wavelength excitations in this case, whereas the light scattering probes short wavelength. Thus, J has indeed been measured experimentally and is nearly four times the value calculated by Goddard and his co-workers (*1*). Indeed, if the value of J calculated by the Goddard group were correct, the original neutron study (*9*) would have been fully capable of resolving it.

Additional corroboration of the experimental value for J is found in the susceptibility measurements of Kastner *et al.* (*13*) [also ignored in (*3*)]. Therefore, the statement of Goddard and his co-workers (*3*) that "no direct experimental value for the systems with Cu-O sheets" exists for J is incorrect. In fact, the value of J has been inferred from light scattering and confirmed by neutron scattering and susceptibility. The values obtained by these various techniques agree within 5%.

Goddard's group (*3*) uses the agreement with the measured J in the case of K_2NiF_4 to argue in favor of their calculational method. They claim an accuracy of 0.0004 eV in J. As shown above, the substantial disagreement in the La_2CuO_4 case (an error of 0.083 eV) argues against such accuracy. Their generalized valence bond procedure involves small differences among the very large state energies, which themselves are typically in error by several electron volts. More serious, they severely truncate the Hilbert space of functions to reduce the calculation to tractable size. The result will depend upon the details of how this truncation is performed. Therefore, the claimed agreement can only be regarded as fortuitous. In contrast, another recent calculation (*14*) with more controlled approximations obtains a value in close agreement with experiment.

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