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Nature of the electronic gap in stripe-ordered cuprates[1]

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The *ab*-plane optical properties of single crystals of the high-temperature superconductor $La_{2-x}Ba_xCuO_4$, with chemical dopings of $x = 0.095$ (slightly underdoped) and 0.125 (1/8 doping) and critical temperatures (T_c's) of 32 and $\simeq$ 2.4 K, respectively, have been measured over a wide frequency and temperature range. The optical conductivity has been determined from a Kramers-Kronig analysis. In the slightly underdoped material, the reflectance increases monotonically over the far-infrared frequency range, with an abrupt increase in the reflectance below T_c below about 200 cm^{-1} (about 25 meV) signaling the formation of a superconducting energy gap; the suppression of the conductivity for $T \ll T_c$ occurs below this energy. This is close to the estimate of the gap maximum $2\Delta_0$ determined from angle resolved photoemission spectroscopy. In contrast, the 1/8 doping shows a dramatically different behavior.[2] The reflectance increases monotonically with decreasing temperature. Below $\simeq$ 60 K, corresponding to the onset of charge-stripe order, the far-infrared reflectance continues to increase; however, the reflectance over much of the infrared is suppressed. The conductivity, Drude-like above the ordering temperature, shows a rapid loss of spectral weight below about 40 meV for $T < 60$ K. This behavior is quite different from that typically associated with the pseudogap in the normal state of the cuprates. Instead, the gapping of the normal-state single-particle excitations looks surprisingly similar to that observed in superconducting $La_{2-x}Sr_xCuO_4$, including the presence of a residual Drude peak with reduced weight.

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[2]C.C. Homes *et al.*, Phys. Rev. Lett. **96**, 257002 (2006).