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Superconducting coherence along c-axis in the stripe phase of high-Tc cuprates

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K. Tanaka, Y. Sakai, T. Miyake, S. Miyazaki, S. Miyasaka and S. Tajima,
Department of Physics, Osaka University, 1-1 Machikaneyama, Toyonaka, Osaka 560-0043, Japan

M. Tonouchi
Institute of Laser Engineering, Osaka University, 2-6 Yamadaoka, Suita, Osaka 565-0871, Japan

T. Sasagawa
Materials and Structures Laboratory, Tokyo Institute of Technology, 4259 Nagatsuta, Midori-ku, Yokohama Kanagawa 226-8503, Japan

Recently, a two-dimensional superconducting state has been reported from transport studies in the stripe-ordered La2−xBaxCuO4 with x = 1/8 [1]. This is consistent with the results of c-axis (E//c) infrared optical studies for La2−xBaxCuO4 and La2−x−yNdySrxCuO4, that the Josephson plasma edge originating from the Josephson coupling of the CuO2 planes disappears in the stripe phase [2]. These results indicate the disappearance of the superconducting coherence along c-axis and the decoupling of the CuO2 planes. To clarify the universality of this phenomena, we performed terahertz time-domain spectroscopy (THz-TDS) measurement, in which one can obtain lower frequency information than the conventional Fourier transform type spectrometer, on static stripe-ordered La1.84−yEuySr0.16CuO4 (y = 0, 0.1, 0.2) and La2−x−yNdySrxCuO4 (x=0.125, 0.16, y=0.1~0.5), where the stability of the stripe phase can be controlled by y. We found that the Josephson plasma edge shows systematic shift to the lower frequency with increasing y and survives in the extremely low frequency region in the stripe-ordered phase. By comparing the superfluid density along c-axis and in-plane, we conclude that the system is not going toward two-dimensional superconducting state with stabilizing the stripe order.

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Primary author: TANAKA, Kiyohisa (Osaka University)

Presenter: TANAKA, Kiyohisa (Osaka University)

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