Momentum-Structure of Remnant Mott-gap in Prototype Doped Cuprates

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Momentum dependence of charge excitation of 2-D prototype cuprate classes La$_{2-x}$Sr$_x$CuO$_4$ and Nd$_{2-x}$Ce$_x$CuO$_4$ with different doping levels (x) is measured using high resolution resonant inelastic X-ray scattering. Although a low-energy continuum is built up with doping, a remnant excitation gap behavior continues to exist even in highly doped metallic phases which we have studied in some detail. The excitation of the Mott gap becomes less dispersive asymmetrically with the increase of doping level and suggests a many-body coupling between charge fluctuation and magnetic order of the lattice. The results can be qualitatively described within the framework of t-t'-t''-U model.

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