Electronic states of single unit cell thick perovskite materials

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Novel properties atomically thin systems may be obtained via dimension control. An approach to achieve such systems is through ultra thin film growth. In this presentation, I wish to introduce our research efforts to measure and manipulate electronic properties of one unit-cell (uc) thick thin films by using thin film growth and *in-situ* angle resolved photoemission (ARPES). More specifically, I will discuss the results of single unit cell $SrIrO_3$ (SIO) and half unit cell or single CuO_2 plane $(La,Sr)_2CuO_4$ (LSCO).

A single uc SIO film shows electronic structure similar to that of Sr_2IrO_4 with the relativistic Mott insulating state with (short) AF order, as expected considering the equivalent structure between 1 uc SIO and Sr_2IrO_4. However, metallic states can be induced via strain on SIO film and spectral features become more pronounced, making it possible to do detailed polarization dependent experiments. The results of polarization dependent experiments[1] suggest that the ground state of 1 uc SIO has a nematic order, similar to the result of a recent report[2].

ARPES studies on a half uc LSCO are also performed[3]. The overall band structure is similar to that of bulk LSCO. With the doping determined from the Luttinger sum rule, an overdoped 1 uc LSCO is found to have a gap with its momentum and temperature dependent behaviors similar to those of thick films and reported bulk results. These results suggest that the observed *d*-wave like gap of a sinlge CuO_2 plane is likely of a superconducting origin, which in turn suggests that the high temperature superconductivity is retained even in a single CuO_2 plane.

[1]J. Y. Kim, in preparation
[2]H. Kim et al., Nature 625, 264 (2024)
[3]Y. D. Kim, *"Superconductivity in Isolated Single Copper Oxygen Plane"*, under review.