

STM imaging of broken symmetry states in cuprate superconductors

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We use scanning tunneling microscopy to image the interactions between two broken symmetries, inversion symmetry and rotational symmetry, within the CuO_2 unit cell of the cuprate superconductor $(\text{Bi}_{1-y}\text{Pb}_y)_2\text{Sr}_2\text{CuO}_{6+x}$. In Bi-based cuprates, a bulk structural buckling known as the “supermodulation”, breaks these symmetries. We use Pb doping to suppress the supermodulation and therefore address the native electronic symmetry breaking states. We find a dominant inversion symmetry breaking, which leads to the appearance of a nematic order. We define a new nematic order parameter which disentangles the two effects of inversion symmetry breaking and rotational symmetry breaking.