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**Local Dimensionality of the Charge Density Wave in the Superconducting Cuprate Bi2201**[1]

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Charge density wave (CDW) states were recently recognized as universal throughout the surface and bulk of a number of cuprates [1], prompting widespread effort to understand both their detailed phenomenology and their relationship to the mechanism of superconductivity. However, the dimensionality of the charge modulations remains unclear, including whether the modulation wavevector is unidirectional or bidirectional in-plane, and also the extent of inter-plane coherence of the charge modulations. In bismuth-based cuprates, severe material disorder precludes answering these questions through bulk scattering techniques. We use a local technique, scanning tunneling microscopy, to image the static charge modulations in $(Pb,Bi)_2(Sr,La)_2CuO_{6+x}$ (Bi2201). We find that the charge modulations are more consistent with an underlying tendency to unidirectional than bidirectional CDW. Using recently developed cluster analysis techniques, we further show that these locally unidirectional CDWs extend coherently into the bulk of the material throughout the doping range. Finally, we comment on their relationship to a Fermi surface transition and quantum critical point observed in Bi2201 [3].

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