Charge dynamics in an incommensurate layered cuprate $Sr_{14}Cu_{24}O_{41}$: A momentum-resolved study LEWIS WRAY, DONG QIAN, DAVID HSIEH, MATTHEW XIA, Princeton University, HIROSHI EISAKI, Nanoelectronics Research Institute (NeRI), ZAHID HASAN, Princeton University — We report the first momentum resolved charge mode spectrum of insulating $Sr_{14}Cu_{24}O_{41}$ using inelastic resonant x-ray scattering. Our results show that the intense excitation modes at the charge gap edge predominantly originate from the ladder-containing two-dimensional planes. The observed modes (E vs. Q) are found to be dispersive for momentum transfers along the “legs” ($\vec{Q} \parallel \hat{c}$) but nearly localized along the “rungs” ($\vec{Q} \parallel \hat{a}$). Dispersion and peakwidth characteristics are strongly similar to the low energy charge spectrum of quasi-one dimensional $SrCuO_2$, and we suggest a qualitative explanation in terms of a model in the strongly correlated limit ($U \gg t$). This behavior is in marked contrast to the charge spectrum observed in most two dimensional cuprates. Quite generally, our results also show that momentum-tunability of inelastic scattering can be used to resolve mode contributions in multi-component correlated systems.

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