Single reconstructed Fermi surface pocket in the pseudogap regime of a single layer cuprate superconductor

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The observation of a small reconstructed Fermi surface with quantum oscillations in the underdoped cuprates opened an avenue towards identifying ordered states in the pseudogap regime. However, such attempts have proven inconclusive -- either due to the complicated multi-frequency spectrum of quantum oscillations or the limited data quality. Our high-resolution quantum oscillation study utilizing magnetic fields of up to 90 T on the structurally simple single-layer cuprate $HgBa_2CuO_{4+\delta}$ (Hg1201) reveals a Fermi-surface constituted of only a single pocket. Our results allow for quantitative modeling of biaxial reconstruction by the previously reported charge-density-wave, which yields an electron-like pocket in excellent agreement with the observed quantum oscillation frequency. Furthermore, we determine a small interlayer hopping which rules out "criss-crossed" uniaxial charge stripes as a viable alternative to bi-axial order. Finally, we find a lower limit of the characteristic gap to be a significant fraction of the pseudogap energy. Overall, our results suggest Fermi-surface reconstruction by bi-axial charge density wave acting on pre-gapped Fermi arcs.

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