Quantum Oscillations in the Underdoped Cuprate $\text{YBa}_2\text{Cu}_4\text{O}_8$\textsuperscript{1}

EDWARD YELLAND, University of St Andrews, UK, JOHN SINGLETON, CHUCK MIELKE, NEIL HARRISON, FEDOR BALAKIREV, LANL, BOGDAN DABROWSKI, Northern Illinois University, MARCIN MATUSIAK, JOHN COOPER, University of Cambridge — The quantum oscillations (QOs) seen in the underdoped cuprate superconductor $\text{YBa}_2\text{Cu}_4\text{O}_8$ (Y124) in magnetic fields up to $B=85T$ [1] are strong evidence for a well-defined Fermi surface (FS) in Y124 at low temperature $T$ and high $B$. The QO frequency $F=660\pm15T$, implies a FS pocket with 2.4% of the full Brillouin zone (BZ) area. Taken with earlier work [2], our data suggest FS pockets are generic to underdoped CuO$_2$ planes and give the first hint of doping dependence of the FS. We discuss the carrier concentration implied by the QOs within various models. Comparison of the T-linear specific heat $\gamma$ (from QO quasiparticle mass $m^*$) to $\gamma$ estimated from zero-field specific heat measurements constrains the number of FS pockets present in the BZ and supports a reduced BZ due e.g. to a charge/spin density wave or ordered orbital currents. [1] E. A. Yelland et al, arXiv:0707.0057. [2] N. Doiron-Leyraud et al, Nature 446, 565 (2007)

\textsuperscript{1}Thanks to EPSRC (U.K.) for financial support. Work supported by DoE grants LDRD-DR-20070085 and BES fieldwork grant, ”Science in 100T”. Work at NHMFL is performed under the auspices of the National Science Foundation, DoE and the State of Florida