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A universal order underlying the pseudogap regime of the underdoped high T_c cuprates[1]

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A major achievement in condensed matter physics in the last quarter century has been a step towards the understanding of the unconventional d-wave superconducting state in the copper-oxide materials. Surprisingly, the normal state out of which the superconducting state emerges remains a mystery at low charge carrier densities, i.e., in the underdoped regime. This regime is of particular interest because it is characterised by an unusual momentum dependent energy pseudogap in the excitation spectrum that has defied explanation and is key to a full understanding of the unconventional d-wave superconducting state. I will present new quantum oscillation experimental results within the pseudogap regime of the high T_c superconductors $YBa_2Cu_3O_{6+x}$ and $YBa_2Cu_4O_8$ which now extend up to the optimally-doped regime. These data reveal the evolution of the Fermi surface approaching the putative quantum critical point under the superconducting dome. A comprehensive angle-resolved study of the Fermi surface enables us to unambiguously identify a specific form of order that accounts for the observed quantum oscillations as well as other spectroscopic, transport and thermodynamic probes within the pseudogap regime. The author would like to thank B. Ramshaw, S. Sebastian, F. Balakirev, C. Mielke, M. Altarawneh, P. Goddard, S. Sabok, B. Babrowski, D. Bonn, W. Hardy, R. Liang and G. Lonzarich.

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