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CFEL Seminar rooms I-III (DESY Bldg. 99)

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Fermi Surface and Pseudogap Evolution in a Cuprate Superconductor

The unclear relationship between superconductivity and the overlapping pseudogap state remains a significant impediment to understanding the high temperature (T_c) superconducting mechanism in cuprates. Here we employ magnetic-field-dependent scanning tunneling microscopy to provide phase-sensitive proof that d-wave superconductivity coexists with the pseudogap on the antinodal Fermi surface of overdoped Bi2201. Furthermore, by tracking the doping dependence within this single cuprate family, we observe the abrupt disappearance of all antinodal states slightly below optimal doping, signifying a Fermi surface reconstruction and zero-field quantum phase transition in striking proximity to the maximum superconducting T_c . Surprisingly, this major reorganization of the system's underlying electronic structure has no impact on the smoothly evolving pseudogap.

