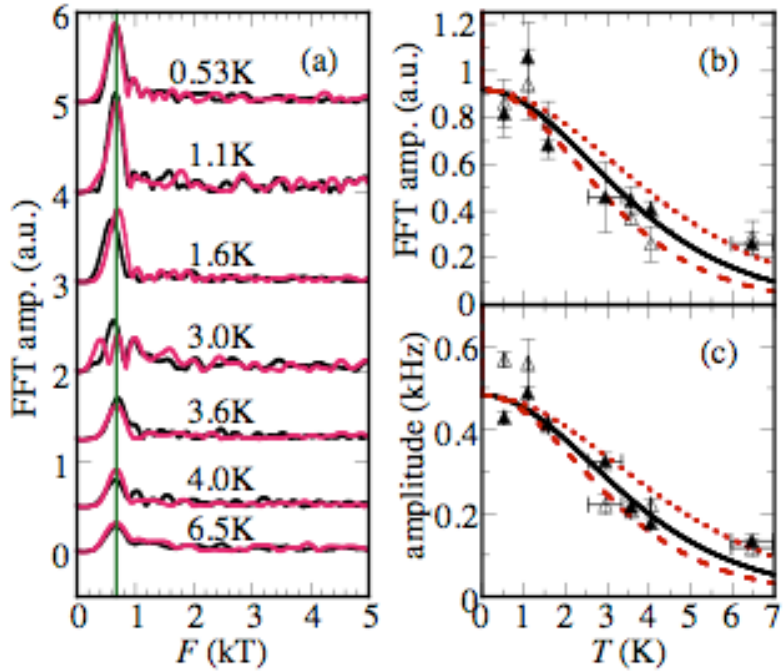
Magneto Quantum Oscillations in $YBa_2Cu_4O_8$

National High Magnetic Field Laboratory

Pulsed Field Facility User Program, Los Alamos National Laboratory

Since the discovery of high temperature superconductors, clear magneto quantum oscillations have eluded researchers for nearly two decades. Experimental classification of these systems potentially holds the key to understanding the fundamental superconducting mechanism.

Users of the NHMFL in collaboration with staff members were able to employ advanced contactless conductivity techniques to reveal for the first time the Fermi Surface cross sectional area of $YBa_2Cu_4O_8$. Data are shown in the figure that show clear magneto quantum oscillations.



The temperature dependence of the magneto quantum oscillation amplitude (FFT amp.). The FFT amplitude temperature dependence is used to determine the effective mass of the superconducting quasi-particles.

Yelland, E.A.; Singleton, J.; Mielke, C.H.; Harrison, N.; Balakirev, F.F.; Dabrowski, B. and Cooper, J.R., **Phys. Rev. Lett.**, **100**, 047003 (2008)

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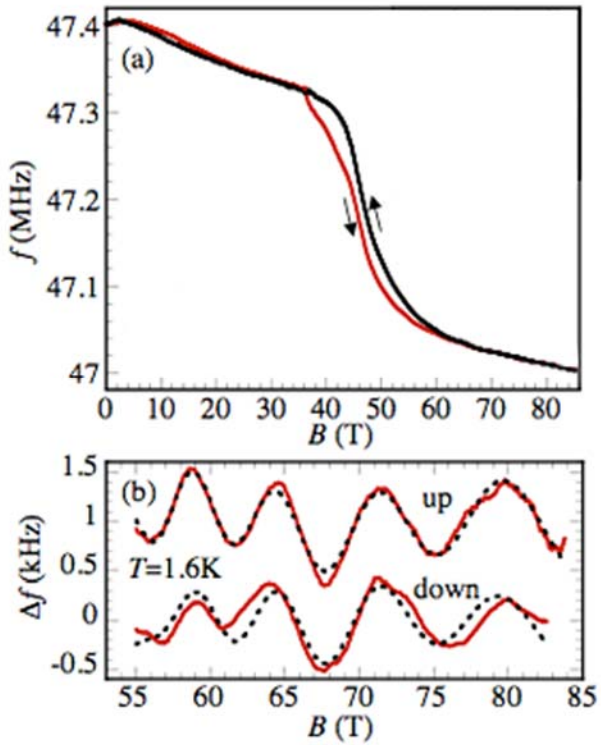

The resonant frequency of the tunnel diode oscillator (a) responds to the sample resistance changes during an 85T magnetic field pulse. (b) Closeup of the resistance oscillation during the field upsweep and downsweep.

High temperature superconductors hold the promise to greatly reduce the energy footprint of the United States. Research at the NHMFL continues to make a significant impact on the experimental characterization of advanced materials. This type of detailed and exhaustive research effort requires cutting technologies and highly motivated teams of researchers. High magnetic field systems such as the 100T-MS magnet and the 45T hybrid magnet are essential tools for materials research. The NHMFL supports many of the world's scientific experts in advanced instrumentation techniques and magnet system development and operation.

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