BROKEN ROTATIONAL SYMMETRY ON THE FERMI SURFACE OF $YBa_2Cu_3O_{6.58}$

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Broken rotational (C_4) symmetry is a distinguishing feature for a number of experiments in the underdoped high-T_c cuprates, including electrical resistivity [1], neutron scattering [2,3], the Nernst coefficient [4], and scanning tunneling microscopy [5]. This broken symmetry, however, has not been observed on the Fermi surface—with or without the presence of an applied magnetic field. We measure the angle-dependent magnetoresistance—a quantity known to be extremely sensitive to the geometry and symmetry of the Fermi surface—of YBa_2Cu-$_2O_{6.58}$, and find that the Fermi surface has a clear two-fold symmetry, breaking the C_4 symmetry of the copper-oxide planes. We discuss the implications of this finding, including how it fits with recent X-ray measurements in high magnetic fields, with quantum oscillation determinations of the Fermi surface [7], and with our own recent finding of a mass enhancement near p = 0.18 [8].

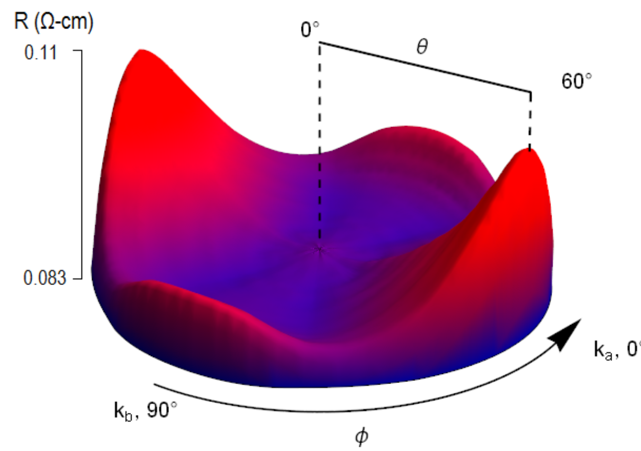

Figure 1: Magnetoresistance of $YBa_2Cu_3O_{6.58}$ as a function of polar (θ) and azimuthal (ϕ) angles, at 45 tesla and 15 kelvin. A clear two-fold anisotropy is seen in the data, with larger magnetoresistance observed when the field is pointed along the a-axis (ϕ = 0).

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