YAMAJI OSCILLATIONS DUE TO MAGNETIC BREAKDOWN IN AN ORGANIC SUPERCONDUCTOR SUBMITTED TO LARGE HYDROSTATIC PRESSURES AND HIGH FIELDS

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The angle-dependent magnetoresistance of κ-(BEDT-TTF$_2$Cu(NCS$_2$ has been examined as a function of pressure *P*. The experiments employed a miniature diamond-anvil cell, built at NHMFL-Tallahassee, attached to a cryogenic goniometer made by Oxford University and providing full two-axis rotation at ^{3}He temperatures [1,2]. The apparatus was placed in a 33 T Florida-Bitter magnet. A plethora of angle-dependent magnetoresistance oscillations (AMROs) is observed at each pressure (Figure 1), caused by field-induced quasiparticle orbits across the Fermi surface [1,2]. Raising *P* suppresses the gap between the quasi-two-dimensional pocket and quasi-one-dimensional sheets of the Fermi surface, increasing the probability of magnetic breakdown. This permits Yamaji oscillations due to breakdown orbits about the complete Fermi surface, a phenomenon long predicted but never before observed. These AMROs, and other magnetoresistance features also allow the evolution of the three-dimensional Fermi-surface topology to be derived as a function of pressure, information relevant for models of organic superconductivity.

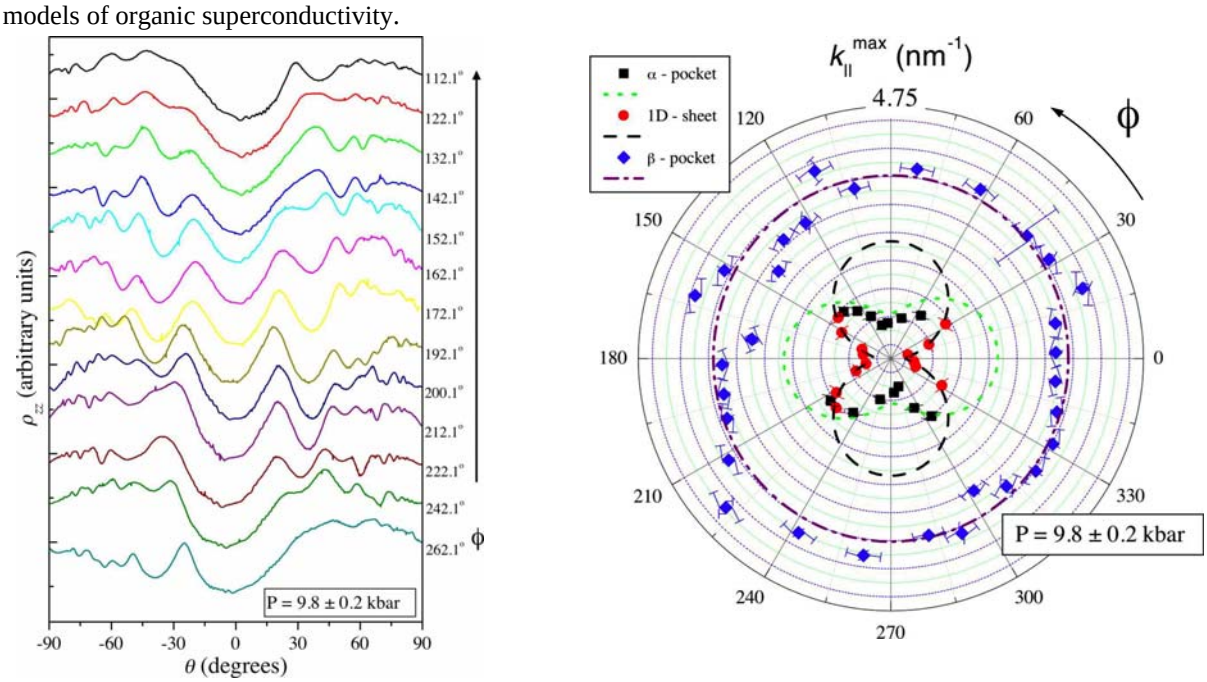

Figure 1. Left: typical angle-dependent magnetoresistance oscillations (AMROs) at a magnetic field of 30 T and a temperature of 1.5 K; the pressure is 9.8 kbar. Here, θ denotes the angle between the normal to the sample's quasi-two-dimensional planes and the field; φ describes the plane of rotation [1]. Right: polar plot of the periodicities (in units of tanθ) of the various AMRO series. The inset key gives the mechanism for the features, with the blue diamonds representing the Yamaji oscillations due to magnetic breakdown (after [2]).

References

[1] Goddard, P.A., *et al.*, Phys. Rev. B, **69**, 174509 (2004).
[2] Bangura, A.F., *et al.*, preprint.