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Giant Magnetoresistance in Organic Superconductors κ–(BEDT-TTF)$_2$Cu(NCS)$_2$

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Abstract

In this letter, we report transport measurements with field and current parallel to the a axis (perpendicular to the conducting plane) in the organic superconductor κ–(BEDT-TTF)$_2$Cu(NCS)$_2$.The magnetoresistance displays a peak effect as a function of field and temperature with the peak fields increasing linearly with decreasing temperatures. The peak resistance is found to be greater than the normal state value extrapolated from both high and low field measurements. This is a first report of above normal resistance in a superconducting state. The results are in sharp contrast to the conventional dissipation mechanisms in the mixed state for anisotropic superconductors, as in the case of $Bi_2Sr_2CaCu_2O_8$. We propose a phenomenological model that the peak in the magnetoresistance is caused by a new scattering mechanism due to a strong coupling to the underlying crystal lattice of fluctuating vortices (vortex polarons). The model can semiquantitatively fit the data.

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