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The coherence conundrum in BEDT-TTF superconductors; how does interlayer transport die as temperature rises?[1] JOHN SINGLETON, Natl. High Magnetic Field Lab, PAUL GODDARD, ARZHANG ARDAVAN, Oxford University Physics, STAN TOZER, ROSS MCDONALD, Natl. High Magnetic Field Lab, JOHN SCHLUETER, ANL — Recent attention has focused on "bad metals", systems which appear to be Fermi liquids at low temperatures (T), but whose conductivity falls below the minimum metallic limit as T rises. A key question concerns the coherence of the electron orbitals, and whether, as suggested by Anderson and others, it is destroyed by thermal fluctuations as T rises. To address this, we have studied magnetic-field-orientation-dependent transport in the organic superconductor (BEDT-TTF)$_2$Cu(NCS)$_2$ at temperatures of up to 45 K in magnetic fields of up to 45 T. This material was chosen because its Fermi surface (FS) is well characterized by experiment. We find that the angle-dependent magnetoresistance oscillations (AMROs) due to orbits on the quasi-one-dimensional (Q1D) and Q2D FS sections are suppressed by rising T, with a T dependence suggesting phonon scattering. The coherence peak in the resistivity seen in exactly in-plane fields, and other signatures of a 3D FS, remain to values of T that exceed the proposed Anderson criterion for incoherent transport by a factor of order 80! The implications of these data for currently-held ideas about bandstructure will be discussed.

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