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Infrared Probe of the Anomalous Magneto-transport of Graphite in the Extreme Quantum Limit

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We present a systematic investigation of the magnetorefectance of highly oriented pyrolytic graphite in magnetic fields B up to 18 T . From these measurements, we report the determination of lifetimes τ associated with the lowest Landau levels in the quantum limit. We find a linear field dependence for inverse lifetime $1/\tau(B)$ of the lowest Landau levels, which is consistent with the hypothesis of a three-dimensional (3D) to 1D crossover in an anisotropic 3D metal in the quantum limit. This enigmatic result uncovers the origin of the anomalous linear in-plane magnetoresistance observed both in bulk graphite and recently in mesoscopic graphite samples. This work is a collaboration with Z.Q. Li, S.-W. Tsai, W.J. Padilla, S.V. Dordevic, K.S. Burch, and Y.J. Wang.