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The optical conductivity of quasicrystals: evidence of a Weyl semimetal with 3D Dirac spectrum THOMAS TIMUSK, JULES CARBOTTE, McMaster University, CHRISTOPHER HOMES, Brookhaven National Laboratory, DIMITRI BASOV, University of California, San Diego, SERGEI SHARAPOV, Bogolyubov Institute for Theoretical Physics, Kiev — The optical conductivity of quasicrystals is characterized by an absence of the Drude peak and a conductivity that rises linearly over a wide range of frequencies. The absence of the Drude peak has been attributed to a pseudogap at the Fermi surface but a detailed explanation of the linear behavior has not been found. This unusual behavior is seen in all icosahedral quasicrystal families and their periodic approximants. A simple model that assumes that the entire Fermi surface is gapped, with the exception at a finite set of Dirac points, fits the data. There is no evidence of a semiconducting gap in any of the materials suggesting that the massless Dirac spectrum is protected by topology leading to a Weyl semimetal. The model gives rise to a linear conductivity with only one parameter, the Fermi velocity. In accord with this picture decagonal quasicrystals should have a frequency independent conductivity, without a Drude peak. This is in accord with the experimental data as well.

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