Dielectric anomalies and interactions in the 3D quadratic band touching *Luttinger* semimetal $Pr_2Ir_2O_7$

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Dirac and Weyl semimetals with linearly crossing bands are the focus of much recent interest in condensed matter physics. Although they host fascinating phenomena, their physics can be understood in terms of weakly interacting electrons. In contrast, more than 40 years ago, Abrikosov pointed out that quadratic band touchings are generically strongly interacting. We have performed terahertz spectroscopy on films of the conducting pyrochlore $Pr_2Ir_2O_7$, which has been shown to host a quadratic band touching. A dielectric constant as large as $\varepsilon/\varepsilon_0$ ~180 is observed at low temperatures. In such systems the dielectric constant is a measure of the relative scale of interactions, which are therefore in our material almost two orders of magnitude larger than the kinetic energy. Despite this, the scattering rate exhibits a T^2 dependence, which shows that for finite doping a Fermi liquid state survives, however with a scattering rate close to the maximal value allowed.

References

[1] B. Cheng et al., "Dielectric anomalies and interactions in the 3D quadratic band touching Luttinger semimetal $Pr_2Ir_2O_7$", To appear in Nature Communications (2017); Available at https://arxiv.org/abs/1711.10507