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Giant dielectric anomaly and low frequency transport in a 3D quadratic band touching system: the *Luttinger* semimetal $\mathbf{Pr_2Ir_2O_7}$ BING CHENG, Johns Hopkins Univ, TAKUMI OHTSUKI, Tokyo Univ, DIPANJAN CHAUDHURI, Johns Hopkins Univ, SATORU NAKATSUJI, MIKK LIPPMAA, Tokyo Univ, PETER ARMITAGE, Johns Hopkins Univ — Zero-gap semimetals with linearly crossing bands such as Dirac and Weyl semimetals are the focus of much recent work in condensed matter physics. Although they host diverse and fascinating phenomena, their physics can be understood in terms of weakly interacting electrons. In contrast, it was pointed out more than 40 years ago by Abrikosov that quadratic band touchings generically lead to strongly interacting phases and potentially even richer physics. We have performed a terahertz spectroscopic study of thin films of the conducting pyrochlore $Pr_2Ir_2O_7$, which has been predicted to host a quadratic band touching. We observe a strongly temperature dependent dielectric constant that reaches an abnormally large value of $\tilde{\varepsilon}/\epsilon_0 \sim 180$ at the lowest temperature. These features can be understood by considering it as a slightly doped strongly interacting *quadratic* band touching system. In such systems, the dielectric constant can be regarded as a measure of the size of interactions, which puts our material in the strongly interacting regime where the scale of the electron-hole interactions is two orders of magnitude larger than the scale of the kinetic energy. Despite this, the inelastic scattering rate exhibits a T^2 dependence b

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