Abstract Submitted
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Diamagnetism of nodal fermions in semimetals: graphene and significant others[1] AMIT GHOSAL, PALLAB GOSWAMI, SUDIP CHAKRAVARTY, UCLA — Nodal fermionic excitations are interesting examples of the simplest fermionic quantum criticality in which the dynamic critical exponent $z = 1$, and the quasiparticles are well defined. They arise in a number of physical contexts. We derive the scaling form of the diamagnetic susceptibility, χ, at finite temperatures, T, and finite chemical potential, μ. From measurements in graphene, or in $Bi_{1-x}Sb_x$ ($x = 0.4$), one may be able to infer the striking quantum critical Landau diamagnetic susceptibility of the system at $T = 0$ and $\mu = 0$, $\chi \propto -H^{-1/2}$, $H \to 0$, where H is the magnetic field. Although the quasiparticles in the mean field description of the proposed d-density wave (DDW) condensate in a high temperature superconductors is another example of nodal quasiparticles, the crossover from the high temperature behavior, $\chi \propto -T^{-1}$, and the quantum critical behavior takes place at a far lower temperature due to the reduction of the velocity scale from the fermi velocity v_F in graphene to $\sqrt{v_F v_{DDW}}$, where v_{DDW} is the velocity in the direction orthogonal to the nodal direction at the Fermi point of the spectra of the DDW condensate.

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Sudip Chakravarty
UCLA

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