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Fermi Liquid Theory of a Fermi Ring[1] TOBIAS STAUBER, Instituto de Ciencia de Materiales de Madrid, CSIC, Madrid, Spain, NUNO PERES, Center of Physics and Departamento de Fisica, Universidade do Minho, Braga, Portugal, FRANCISCO GUINEA, Instituto de Ciencia de Materiales de Madrid, CSIC, Madrid, Spain, ANTONIO CASTRO NETO, Department of Physics, Harvard University, Cambridge, USA and Department of Physics, Boston University, Boston,USA — We study the effect of electron-electron interactions in the electronic properties of a biased graphene bilayer. This system is a semiconductor with conduction and valence bands characterized by an unusual "mexican-hat" dispersion. We focus on the metallic regime where the chemical potential lies in the "mexican-hat" in the conduction band, leading to a topologically non-trivial Fermi surface in the shape of a ring. We show that due to the unusual topology of the Fermi surface electron-electron interactions are greatly enhanced. We discuss the possibility of an instability towards a ferromagnetic phase due to this enhancement. We compute the electronic polarization function in the random phase approximation and show that, while at low energies the system behaves as a Fermi liquid (albeit with peculiar Friedel oscillations), at high frequencies it shows a highly anomalous response when compare to ordinary metals.

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