Abstract Submitted for the MAR08 Meeting of The American Physical Society

Charge Carrier Interaction with a Purely Electronic Collective Mode: "Plasmarons" and the Infrared Response of Semi-metal Bismuth N. PETER ARMITAGE, The Johns Hopkins University, RICCARDO TEDIOSI, ENRICO GIANNINI, University de Geneve, LASZLO FORRO, Ecole Polytechnique Federale de Lausanne, DIRK VAN DER MAREL, University de Geneve — We present a detailed pressure and temperature- dependent optical study of singlecrystal bismuth using infrared reflectivity and ellipsometry. In the ambient pressure optical conductivity, an anomalous temperature dependent mid-infrared absorption feature is observed. An extended Drude model analysis reveals that it can be connected to a sharp upturn in the scattering rate, the frequency of which exactly tracks the strongly temperature dependent plasmon frequency. We interpret this absorption and increased scattering as direct optical evidence for a charge carrier interaction with a collective mode of purely electronic origin, here electron-plasmon scattering. The observation of a "plasmaron" as such is made possible by the exceptional properties of semi-metal bismuth, but it is also likely relevant to the low energy transport and thermodynamic properties of other semi-metals, like graphite and graphene. As a function of pressure, we observe massive changes in bismuth's optical and infrared conductivity as the material approaches a Lifshitz-like metal/insulator transition.

> N. Peter Armitage The Johns Hopkins University

Date submitted: 13 Nov 2007

Electronic form version 1.4