MAGNETO-RAMAN SPECTRA DUE TO INTER-LANDAU-LEVEL TRANSITIONS IN GRAPHITE

Y. Ma[1], J. Kono[2], Y. Kim[3], D. Smirnov[3], A. Imambekov[1]
[1]Department of Physics & Astronomy, Rice University, Houston, TX, U.S.A
[2]Department of Electrical & Computer Engineering, Rice University, Houston, TX, U.S.A
[3]National High Magnetic Field Laboratory, Tallahassee, Florida 32310, USA

We analysis the Raman spectroscopy of electronic excitations in graphite, focusing on the temperature dependence of spectral linewidth. In the presence of an external magnetic field parallel to c-axis, in plane motion is quantized into Landau levels, while out of plane motion remains free. Effectively, Landau levels can be treated as one dimensonal bands in graphite, leads to theoretical prediction of von Hove singularity of the spectra at the K point, while experimentally a finite width is observed. From the four bands tight-binding calculation, we find 2 one-dimensional low energy bands crossing the Fermi level with negligible curvature, which makes graphite a candidate for the application of Luttinger liquid (LL) theory. Introducing interaction between excited electron-hole pair and the low energy bands, the von Hove singularity get modified, $(\varepsilon - \Delta)^{-1/2+\beta}$. As the low energy bands are sensitive to temperature, introducing the interaction may give us a possible explanation for the linewidth at finite T. Considering finite temperature behavior of Luttuinger liquid, power law singularity breaks down and the spectra gets broadened with increasing T. According to our model, we predict the linewidth has a linear dependence on temperature.