Polarons in a two dimensional electron gas under extreme FIR radiation power

A. Marchese[1], Y. Lekhai[2,3], D. Kamenskyi[1,2] , B. Bernáth[1], M. Ozerov[2], H. Engelkamp[1], P.C.M. Christianen[1], B. Redlich[2], A.F.G. van der Meer[2], J.C. Maan[2]

[1] *High Field Magnet Laboratory, Radboud University, Nijmegen, The Netherlands*
[2]*FELIX Laboratory , Radboud University, Nijmegen, The Netherlands*
[3]*Department of Physics, University of Surrey, Guildford GU2 7XH, United Kingdom*

Email: andrea.marchese@ru.nl

Polarons are quasi-particles in polar solids arising from a strong electron-phonon interaction, which lowers the mobility of electrons and increases their effective mass. This mass enhancement can be measured by cyclotron resonance experiments (see Fig. 1a). We investigate the properties of a two dimensional electron gas in AlGaAs/GaAs heterojunction under the extreme conditions of intense free-electron-laser radiation, in the frequency range of 100-400 cm-1 (12.4-50.0 meV), and in high magnetic fields up to 32 T. At low frequencies we observe the cyclotron resonance of purely electronic character, described by the regular effective electron mass. When the radiation frequency is close to the optical phonon energy, either below or above the reststrahlen band, we find an increased effective mass and a remarkable laser power dependence of the cyclotron resonance amplitude and linewidth (see Fig. 1b). We will discuss the obtained results in terms of a model, which takes into account the excitation and relaxation rates of electronic transitions between Landau levels.

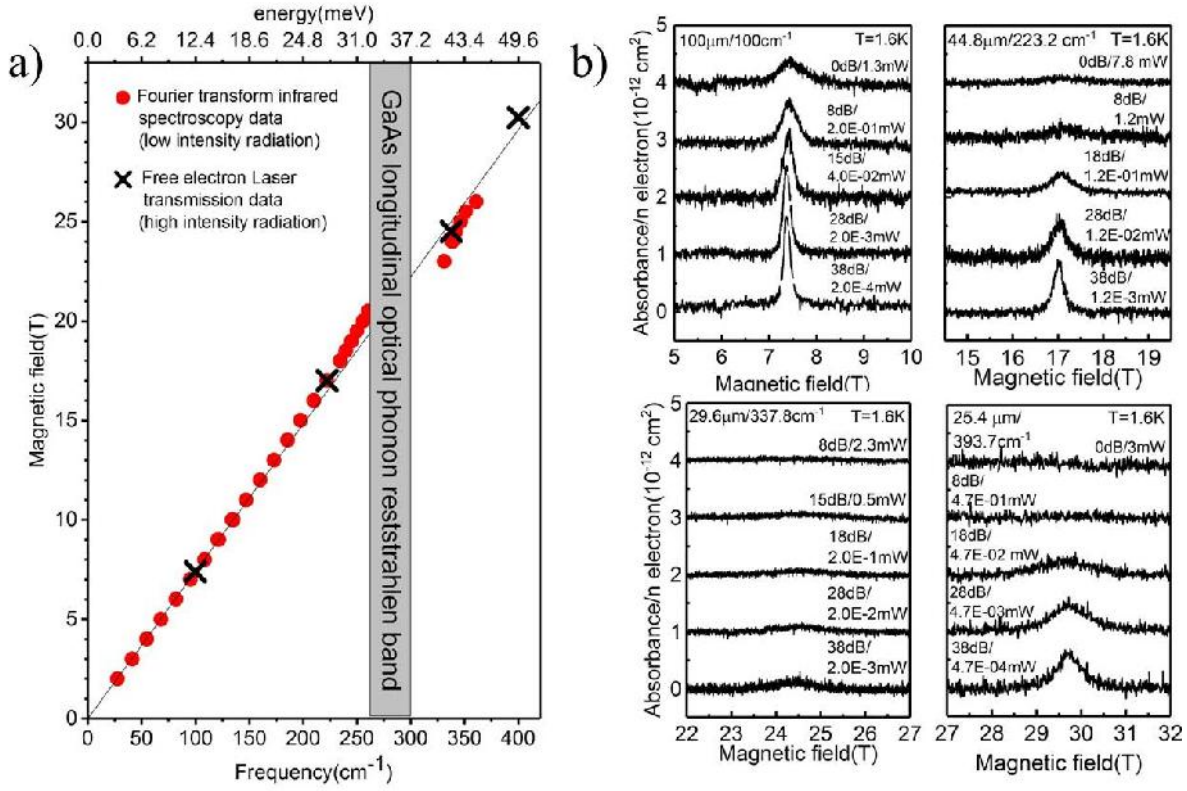

Figure 1 a) Cyclotron resonance measurement on GaAs-AlGaAs heterojunction at low power (red dots) and high power (blue cross). The solid line is a guide for the eye to see the increase of effective mass (i.e deviation from the linearity). **b)** Absorbance (per unit of electron) curves on the same sample at different high powers and laser frequencies. The blue crosses in a) correspond to the frequencies displayed in the right graph.