Cyclotron resonance detected by Photoconductivity at filling factor $\nu = 1$ and 2

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We perfom photoconductivity(PC) experiments on two-dimensional electron systems (2DES) by combining magneto-transport with far-infrared spectroscopy.

The sample is a modulation doped GaAs/AlGaAs heterostructure with an electron density $N_s = 1.22 \cdot 10^{11} cm^{-2}$ and a mobility $\mu = 620000 \frac{cm^2}{Vs}$. A very long Hall bar (length 10cm, width 40μm) meandering on an area of 4·4mm^2 is prepared by chemical etching.

We measure the Far-infrared photoinduced change of the magnetoresistance at 2.1K in faraday geometry while applying a constant DC bias current to the Hall bar. The sample is illuminated by the broadband far-infrared radiation of a mercury lamp. The radiation is chopped at 16Hz and the change of magnetoresistance is detected by a Lock-In technique. Additionally we use a Fourier spectrometer to obtain excitation spectra. To achieve this the photoinduced voltage change is fourier transformed by the spectrometer.

We present the far-infrared photoconductivity spectra and the photoinduced change of the magnetoresistance of the 2DES at filling factor $\nu = 2$ and $\nu = 1$. By comparing the lineshapes obtained by PC-spectroscopy with those obtained by transmission spectroscopy experiments we determine the mechanism of the excitation. A difference in lineshape is observed at $\nu = 2$ when low bias currents are applied to the Hall bar. The photoinduced resistance change at the lower magnetic field side of $\nu = 1$ is surprisingly large. A major difference between the resonance at $\nu = 1$ and at $\nu = 2$ is the absence of a double peak behavior at $\nu = 1$.

We attribute the different photoresponse behavior around $\nu = 1$ and 2 to the influence of a spin-flip scattering in the relaxation process, which results in a longer relaxation time at filling factors slightly larger than one.