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February 15, 2017.

I discovered a new type of optical transition in the InAs/GaSb nano-structures. The new discovered transitions may open the way to make a reliable far-infrared photo-detector.

In the last couple of days I worked to figure out the source of the numerous absorption peaks in the magneto-transmission spectra of the Indium Arsenide / Gallium Antimonite quantum wells obtained by my collaborators at NRL in the low-temperature cyclotron resonance experiments performed a couple of years ago (they were not able to find a suitable interpretation of the data in Fig. 1). The positions of the cyclotron resonance peaks are shown in the figure 1 below. The experiments were carried out at a set of fixed far-infrared excitations between 1meV and 250meV with a gas laser pumped by a high power CO2 laser while the magnetic field was swept from 1 Tesla to 25 Tesla. A first set of experiments were carried out at 4.2 K (liquid helium temperature), a second set of experiments were carried out at 77K (liquid nitrogen temperature) and a third set of experiments were carried out at room temperature.

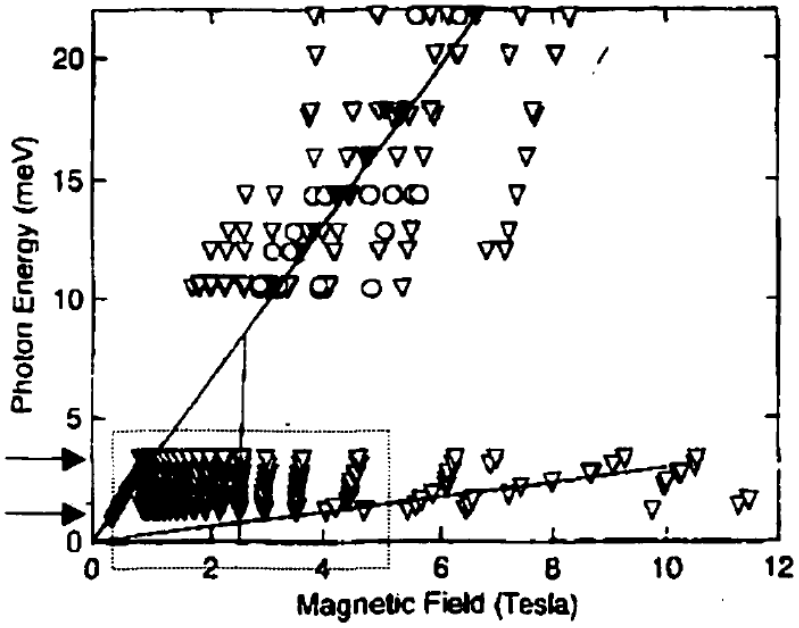

Figure-1

I considered the band structure of the InAs and GaSb and the configurations of the Landau levels in the InAs and GaSb as function of magnetic field. Looking at them I concluded

that the absorption peaks in Fig. 1 are most likely due to interlayer transmission between the valence band in the InAs and conduction band in GaSb. In other words, the photons from the laser source are causing electronic transitions from the valence band of the GaSb into the conduction band of the InAs. This conclusion becomes clearly apparent when considering the Landau level band diagram and the position of the Fermi level as shown in Fig. 2. As seen from the variation of the landau levels close to the Fermi level, the transitions corresponding to valence band in GaSb and conduction band in InAs is clearly correspondent to the absorption peaks in Fig. 1.