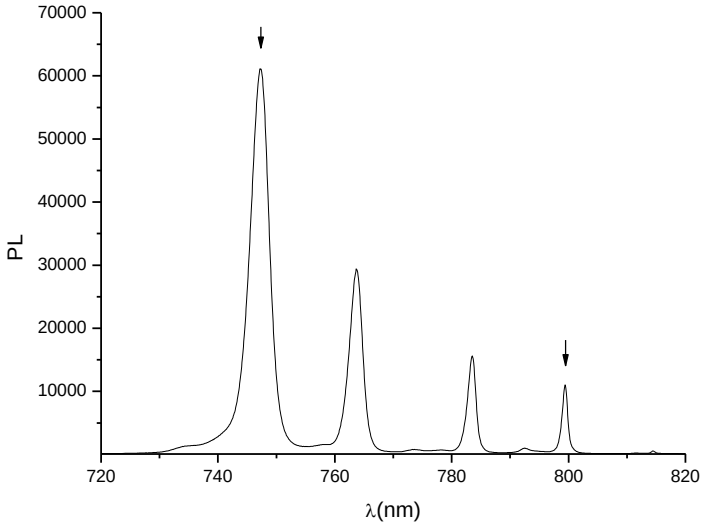
Homework 1 **QUANTUM WELLS**

1. Referring to a two-dimensional GaAs semiconductor system ($m_e=0.07m_0$, $m_h=0.4m_0$, $E_g=1,4eV$):
(a) calculate the density of states at the CB and VB band edges.
(b) calculate the carrier densities in the CB and VB at T=300K, using the Boltzmann approximation and assuming intrinsic semiconductor.
(c) find the quasi-Fermi levels, without using Boltzmann approximation, when the semiconductor is excited optically with $n=p=10^{11}$ cm^{-2} carriers.

2. The following photoluminescence spectrum, obtained at T=2K, is the outcome of electron-heavy hole recombination in GaAs/$Al_{0.26}Ga_{0.74}As$ quantum wells of different thicknesses. It is given that $m_e=0.07m_0$, $m_h=0.4m_0$, $E_g(GaAs)=1.51eV$ and $E_g(Al_{0.26}Ga_{0.74}As)=1.91eV$ at T=2K. Also, that the partition of band gap difference between GaAs and AlGaAs in CB and VB is 2:1. Calculate the thicknesses of the two quantum wells that correspond to the lowest and highest emission energy (see arrows).



Deadline: Tuesday, 20th of October