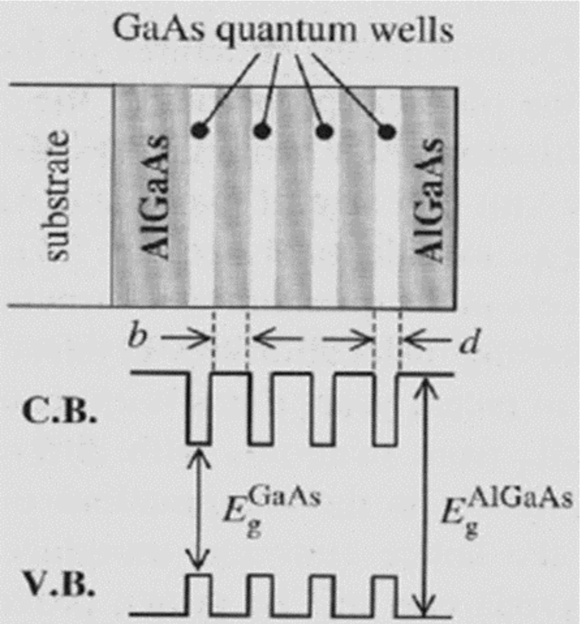
RESONANT BRAGG STRUCTURE

- It consists of semiconductor multiple QWs and has intrinsic electronic excitations such as excitons.

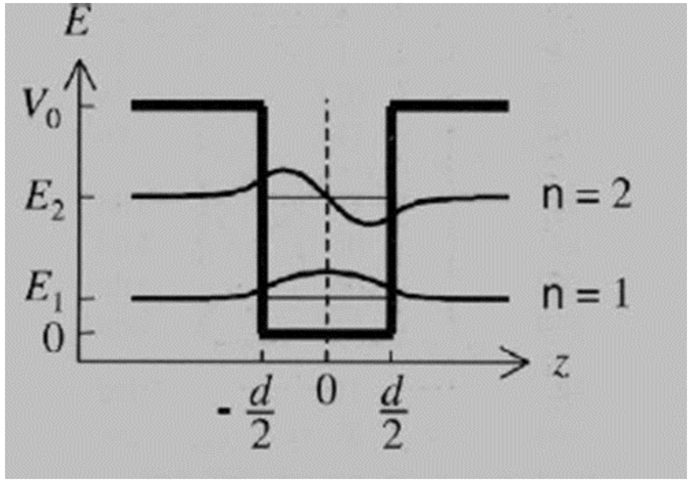
- Periodicity of the system provides the Bragg resonance condition at the photon energy equal to the energy of excitons in the QWs. It has thinner barriers, thus coupled by tunneling through it.

- Bragg diffraction of light by the QW excitons leads to the formation of a super-radiant optical mode at resonance frequency.



Quantum well structure can be explained by the Particle in a box Problem. Solve the Schrodinger equation with the necessary BC

$$-\frac{\hbar^2}{2m^*}\frac{d^2\phi_n}{dz^2}+V(z)\phi_n = E_n\phi_n$$



We got solution of two forms:

$$u = \begin{cases} \text{v tan v (symmetric)} \\ \text{-v cot v (antisymmetric)} \end{cases} \qquad k = \frac{\sqrt{2mE}}{\hbar} \qquad \alpha = \frac{\sqrt{2m^*(v_0 - E)}}{\hbar}$$

$$u = \alpha(\tfrac{L}{2}), \text{ and } \tfrac{kL}{2} = v,$$

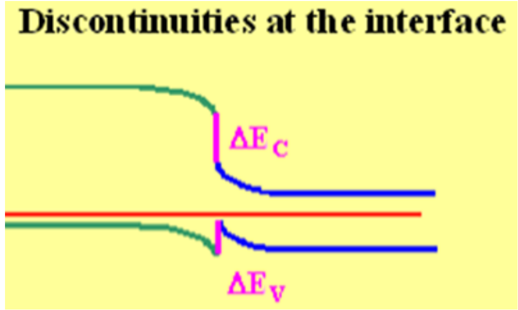
Using $u^2 + v^2 = u_0^2$ and, $u_0^2 = \frac{m^* L^2 V_0}{2\hbar^2}$

$$\sqrt{u_0^2 - v^2} = \begin{cases} \text{v tan v (symmetric)} \\ \text{-v cot v (antisymmetric)} \end{cases}$$

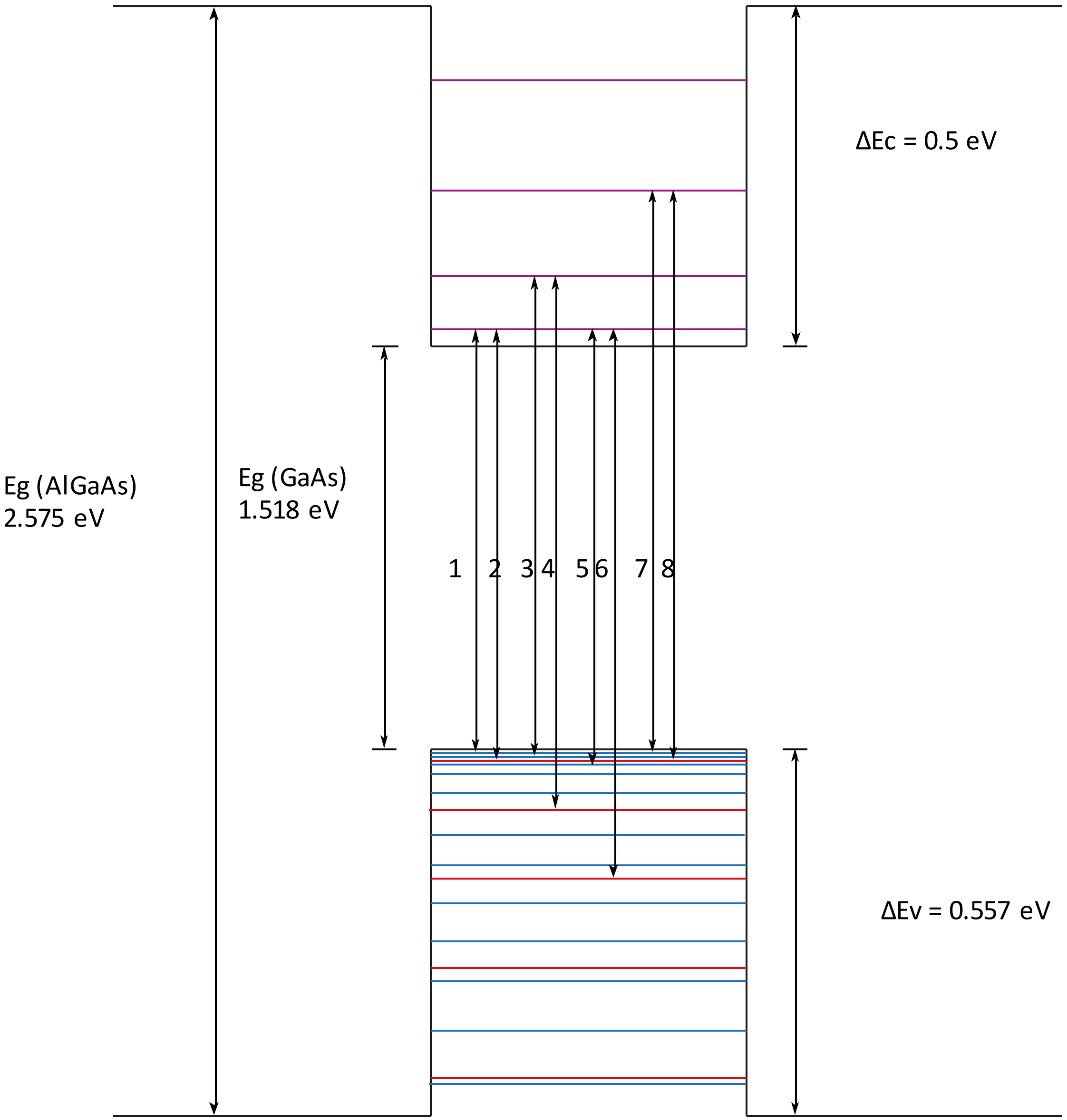
The energy eigen values is given by: $E = \frac{2\hbar^2}{m^* L^2} v_n^2$

The inter-section between the curves $\sqrt{u_0^2 - v^2}$ and $v \tan v$ or $-v \cot v$ gives the v-values and eventually gives the energy values.

QW width, L=12.5nm



To solve the equation numerically for each of electron, light hole and heavy hole as the charge carriers. We need three different plotting and their intersection points.



For GaAs:

Effective mass of electron: $0.067\ m_0$

Effective mass of light hole: $0.087\ m_0$

Effective mass of heavy hole: $0.62\ m_0$