1. XeCl: 308 nm, pulsed

Alexandrite: 700-820 nm, pulsed or CW

Copper vapor: 510 nm, 578 nm, pulsed

He Cd: 325 nm, 440 nm, CW

2. Laser wavelengths 1160-1360 nm (approximate)

Pumping: bands 350-550 nm, 600-850 nm, 850-1200 nm

Most common: Nd:YAG at 1064 nm

$\tau_2 \simeq 3\,\mu s$ at room temperature

$t_s \simeq 25\,\mu s$

3. Many sources exist.

4. Have $N = \int_{E_c}^{\infty} \rho(E)\, f(E)\, dE$

E = energy of states in conduction band

$\rho(E)$ = density of states = $\frac{(2m_e)^{3/2}}{2\pi^2\hbar^3}\sqrt{E-E_c}$

$f(E)$ = distribution function

At $T=0$, $f(E) = 1$ $E_c < E < E_c + E_F$

$= 0$ otherwise

E_F = Fermi level

Need to determine E_F

So $$N = \int_{E_c}^{E_c+E_F} \frac{(2m_c)^{3/2}}{2\pi^2\hbar^3}\sqrt{E-E_c}\,dE$$

$$= \frac{(2m_c)^{3/2}}{2\pi^2\hbar^3}\int_0^{E_F} E^{1/2}\,dE$$

$$N = \frac{(2m_c)^{3/2}}{2\pi^2\hbar^3}\,\frac{2}{3}(E_F)^{3/2}$$

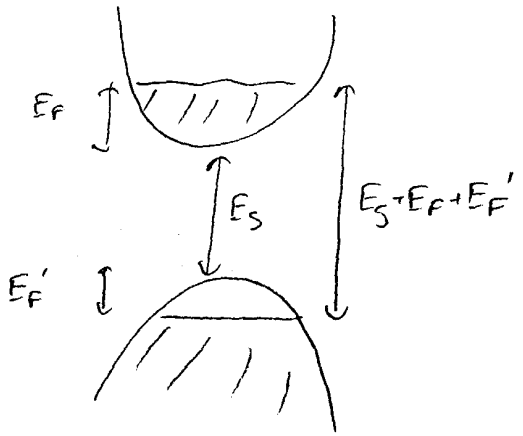
So $$E_F = \left[\frac{3\pi^2\hbar^3 N}{(2m_c)^{3/2}}\right]^{2/3} = \frac{\left[3\pi^2(1.054\times10^{-34}\,Js)^3\cdot 2\times10^{24}\,m^{-3}\right]^{2/3}}{2\cdot 0.07\times 9.1\times10^{-31}\,kg}$$

$$= 1.32\times10^{-20}\,J = 0.0825\,eV$$

Similarly, for holes, get $$E_F' = \frac{m_c}{m_v}E_F$$

$$= \frac{0.02}{0.5}E_F = 1.85\times10^{-21}\,J$$

$$= 0.012\,eV$$



Get gain for frequency ν between E_S/h and $\frac{E_S+E_F+E_F'}{h}$

$E_S = 1.42\,eV = 2.27\times10^{-19}\,J$

$\frac{E_S}{h} = 3.43\times10^{14}\,Hz \rightarrow \lambda = 875\,nm$

$\frac{E_S+E_F+E_F'}{h} = 3.65\times10^{14}\,Hz \rightarrow \lambda = 820\,nm$

Gain from **820 – 875 nm**