07/10 **Práctica 2**

Int. LUT - Memoria

1) Rm x abs de LUT
y de líneas esp.

2) Reglas de selección

3) Dinámica temporal

Demtröder

Ensanchamiento Doppler

$$\delta\omega_D = 2\sqrt{2}\ \frac{\omega_0\, v_w}{c} \qquad v_w^2 = \frac{2k_B T}{m}$$

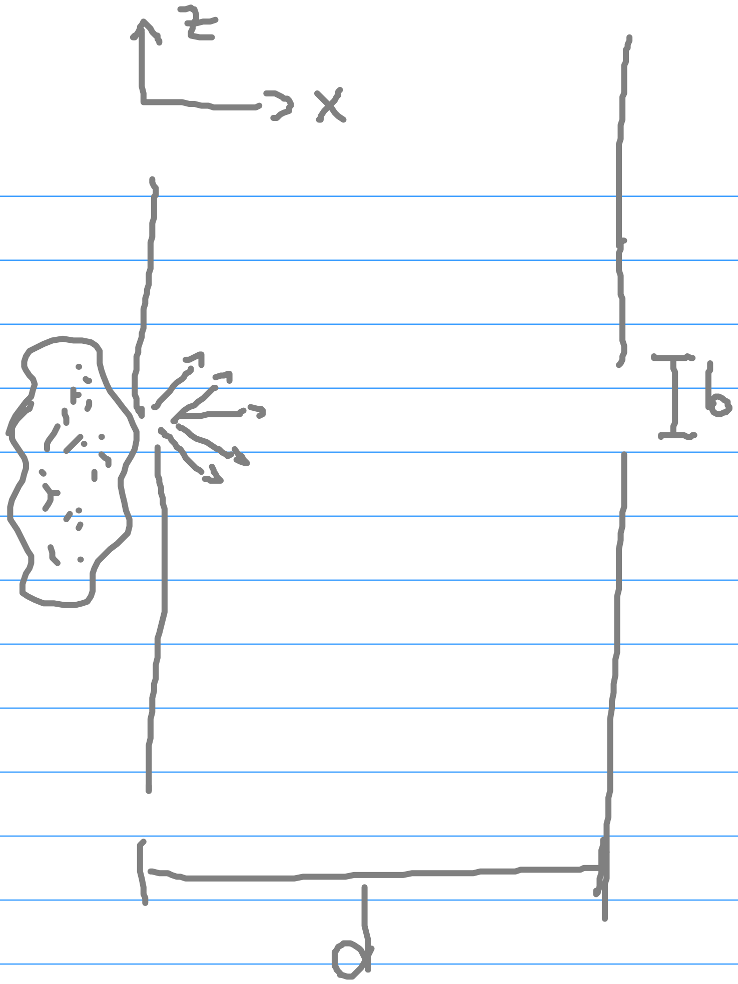
$$\left[\omega = 2\pi\cdot\nu = 2\pi f \qquad T = \frac{1}{\nu} = \frac{2\pi}{\omega}\right]$$

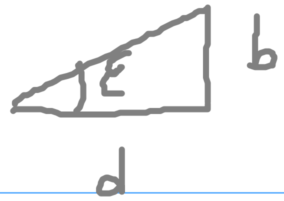
$$\boxed{\delta\nu_D = 7{,}16\cdot 10^{-7} \times \nu_0\sqrt{\frac{T}{M}}\ \text{Hz}}$$

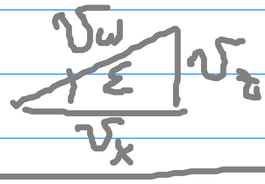
$[\nu_0] = Hz$

$[M] =$ $\rightarrow$ M $\rightarrow$ masa molar (g/mol)

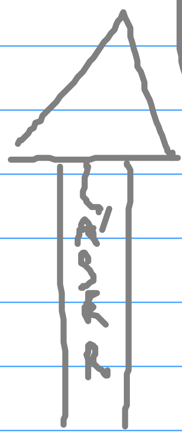
$[T] = K$







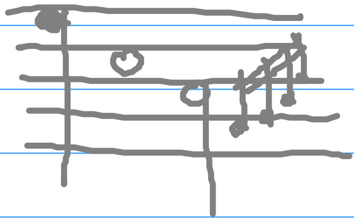
$$\boxed{|v_z| < v \operatorname{sen} \varepsilon}$$



Sen ε

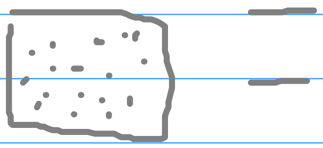
$$\Delta\nu \, \Delta t \cong \frac{1}{2\pi}$$

→ Como llego de acá a $\Delta p \, \Delta x \geq \hbar$?



Quantum theory
Asher Peres

Coefs. de Einstein



$\hbar\omega \qquad \Delta(\omega) \longrightarrow \Gamma$

$$\frac{dP^{Abs}}{dt} = B \int \rho(\omega)\, \Delta(\omega)\, d\omega$$

$$\frac{dP^{Em}}{dt} = B \int \rho(\omega)\, \Delta(\omega)\, d\omega$$

$$\frac{dP^{S}}{dt} = A$$

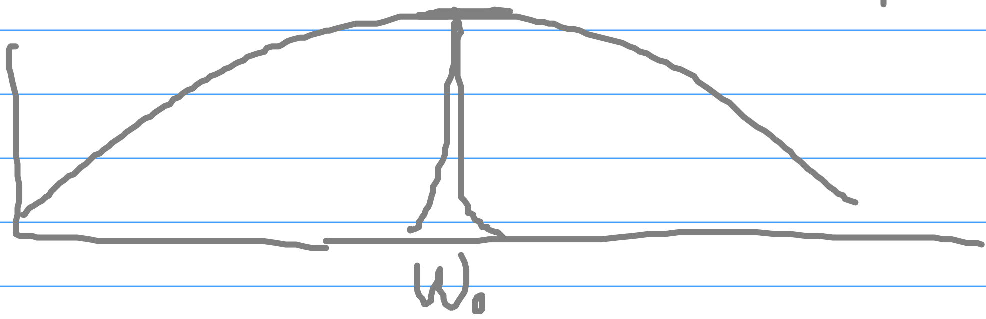
$$\boxed{B = \frac{\lambda^3}{8\pi \hbar} A}$$

$$A = \Gamma$$

- Espectro es ancho
- Monocromática

Broadband

$$\int \rho(\omega)\,\Delta(\omega)\,d\omega = \rho(\omega_0)\int \Delta(\omega)\,d\omega$$



$$\Delta(\omega) = \frac{\Gamma/2\pi}{(\omega-\omega_0)^2 + (\Gamma/2)^2}$$

N átomos $\qquad N_1 \;,\; N_2$

$$\frac{dN_2}{dt} = -\Gamma N_2 + B\rho(\omega_0)(N_1 - N_2)$$

$$0 = -\Gamma N_2 + B\rho\,(N_1 - N_2)$$

$$\Longrightarrow (\Gamma + B\rho)N_2 = B\rho N_1$$

$$N_2 = \frac{B\rho}{\Gamma + B\rho} N_1$$

$$N_2 = \frac{B\rho}{\Gamma + B\rho} N_1 \qquad S = \frac{2B\rho}{\Gamma}$$

$$N_2 = \frac{1}{1 + \Gamma/B\rho} N_1 = \frac{1}{1 + 2/S} N_1$$

$$N = N_1 + N_2 \Rightarrow N_1 = N - N_2$$

$$\Rightarrow \boxed{N_2 = \frac{S}{S+1} \frac{N}{2}} \qquad \text{si } S \to \infty \quad N_2 = \frac{N}{2}$$

$$\frac{dW}{dt} = \hbar\omega \left(\frac{dP^{abs}}{dt} - \frac{dP^{Em}}{dt} \right) =$$

$$= \hbar\omega \left(B\rho N_1 - B\rho N_2 \right)$$

$$= \hbar\omega \frac{\Gamma}{2} \frac{S}{S+1} N$$

$$\xrightarrow[S\to\infty]{} \frac{dW}{dt} = \hbar\omega \frac{\Gamma}{2} N$$

Para 1 átomo: $\frac{dW}{dt} = \hbar\omega \frac{\Gamma}{2}$

Monocromático

$$\int \rho(\omega)\, \Delta(\omega)\, d\omega$$

$$\rho(\omega) = \delta(\omega - \omega_L)\, \frac{I}{c}$$

$$\rightarrow \Delta(\omega_L)\, \frac{I}{c}$$

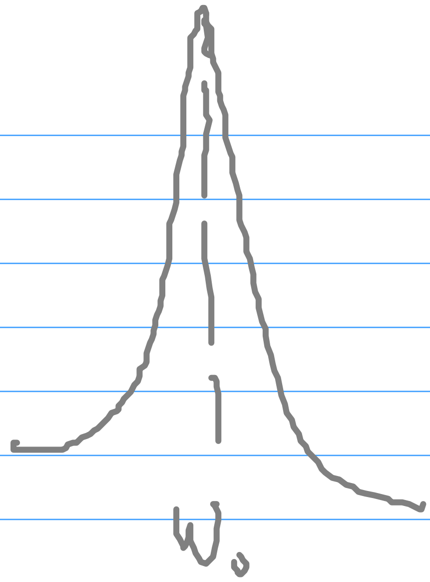
$$\frac{dN_2}{dt} = -A N_2 + B\, \frac{I}{c}\, \Delta(\omega_L)\, (N_1 - N_2)$$

$$\sigma(\omega) = A\, \frac{\lambda_0^2}{4}\, \Delta(\omega) \qquad B = \frac{\lambda_0^3}{8\pi\hbar} A$$

$$\Rightarrow \frac{dN_2}{dt} = -\Gamma N_2 + \frac{\sigma(\omega_L) I}{\hbar \omega_0} (N_1 - N_2)$$

$$S(\omega_L) = \frac{2\sigma(\omega_L) I}{\hbar \omega_0 \Gamma}$$

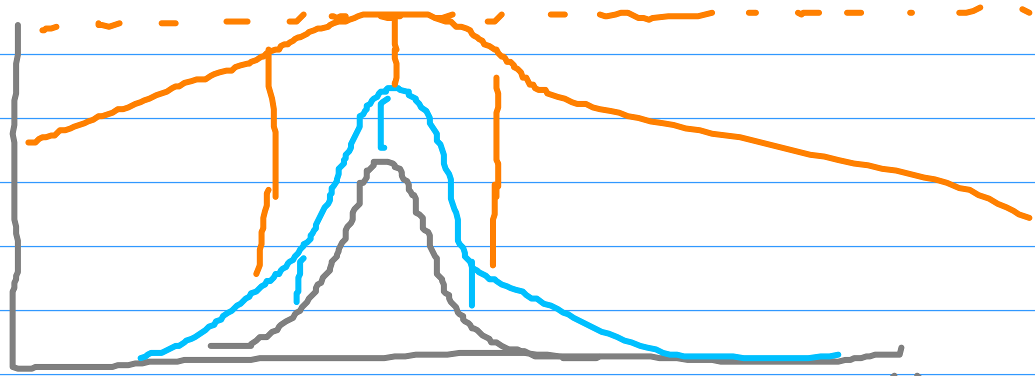
N_1	N_2	N
n.º de at en F_1	n.º de at en el exc	n.º de átomos
$\lvert\langle\Psi\vert\phi_1\rangle\rvert^2$	$\lvert\langle\Psi\vert\phi_2\rangle\rvert^2$	1
ρ_{11}	ρ_{22}	


ω_0

Si resuelvo para el

estacionario:

$$\frac{dW}{dt} = \hbar \omega_0 \frac{\Gamma}{2} \frac{S(\omega_L)}{S(\omega_L)+1} N$$



Biblio: Demtröder
Cap 7

Budker, de eD.
cap 3