$$\langle F\rangle = \mathrm{Tr}[\rho F] = -\frac{\hbar\Omega^*}{2}\left(\frac{\nabla|\Omega|}{|\Omega|} - i\nabla\phi\right)\langle\sigma\rangle + \text{c.c.}$$

$$\tilde{\rho}_{eg} = -\frac{i\Omega}{\Gamma}\frac{1+\frac{i2\delta}{\Gamma}}{1+\left(\frac{2\delta}{\Gamma}\right)^2 + 2\frac{|\Omega|^2}{\Gamma^2}} = -\frac{i\Omega}{2(\Gamma/2 - i\delta)(1+s)}$$

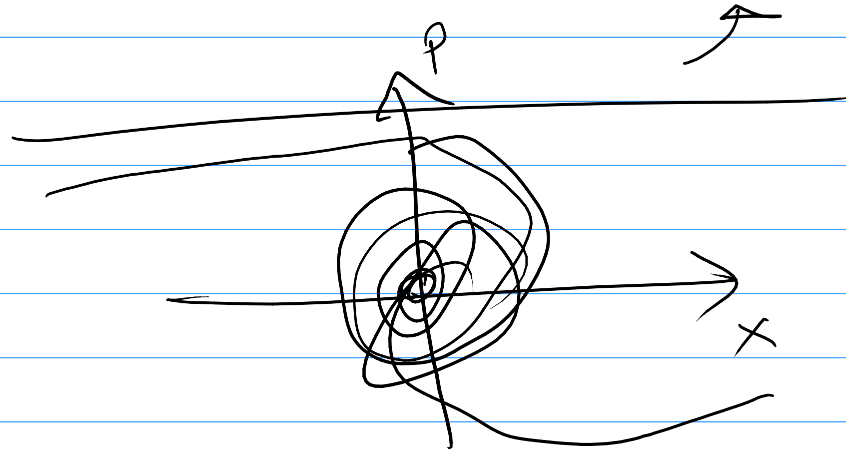
$$\tilde{\rho}_{ge} = \frac{i\Omega^*}{2(\Gamma/2 + i\delta)(1+s)},$$

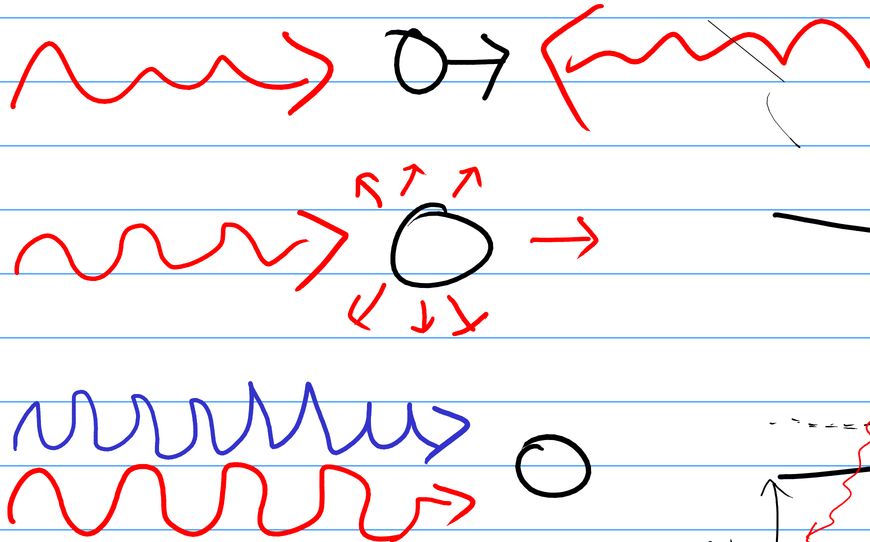
$$\longrightarrow \delta_{eff}^{MOT} = \delta - kv - \beta x$$

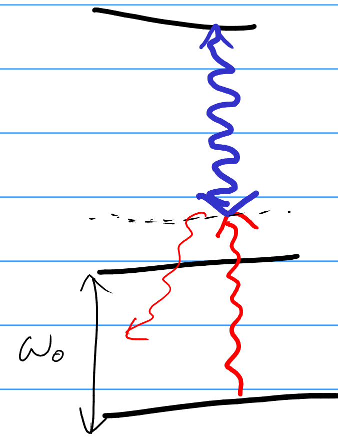
$$\mathrm{Tr}[F\rho(t\to\infty)] = F(v,x) = m\ddot{x}$$

$$\dot{\tilde{\rho}} = -\frac{i}{\hbar}[\tilde{H}, \tilde{\rho}] + \Gamma\mathcal{L}$$

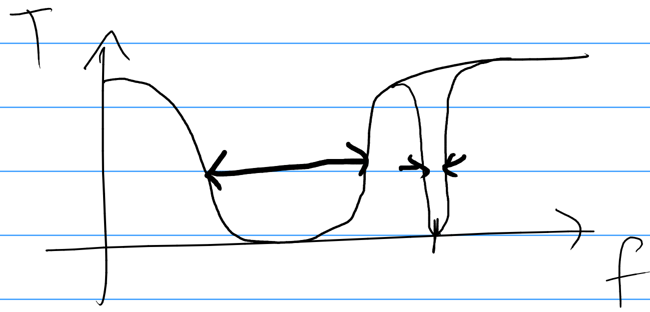
$$\tilde{H} = \hbar\begin{pmatrix} 0 & \frac{\Omega}{2} \\ \frac{\Omega}{2} & -\delta(x,v) \end{pmatrix}$$

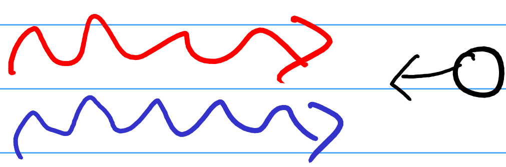


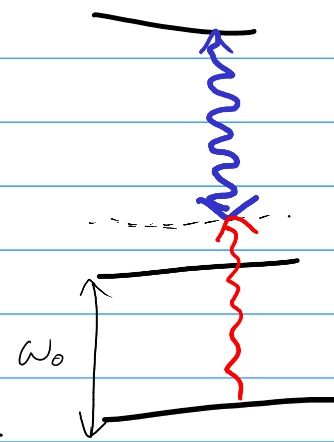




$$\vec{K} + \vec{K} - \vec{K} + \vec{K}'$$







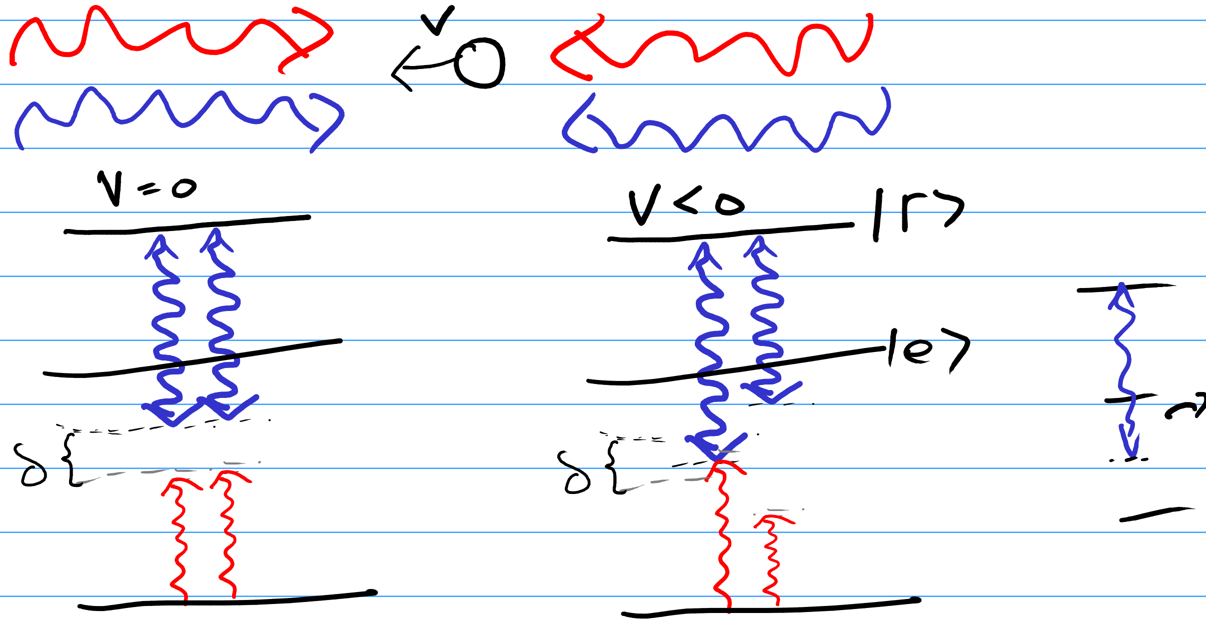
$$\delta^{480} = K_{480} \cdot V \qquad \delta^{780} = K_{780} \cdot V$$

$$\frac{\delta^{480}}{\delta^{780}} = \frac{K_{480}}{K_{780}} = \frac{780}{480} = 1.625$$

$$\delta_{eff} = \delta + \delta^{480} + \delta^{780}$$

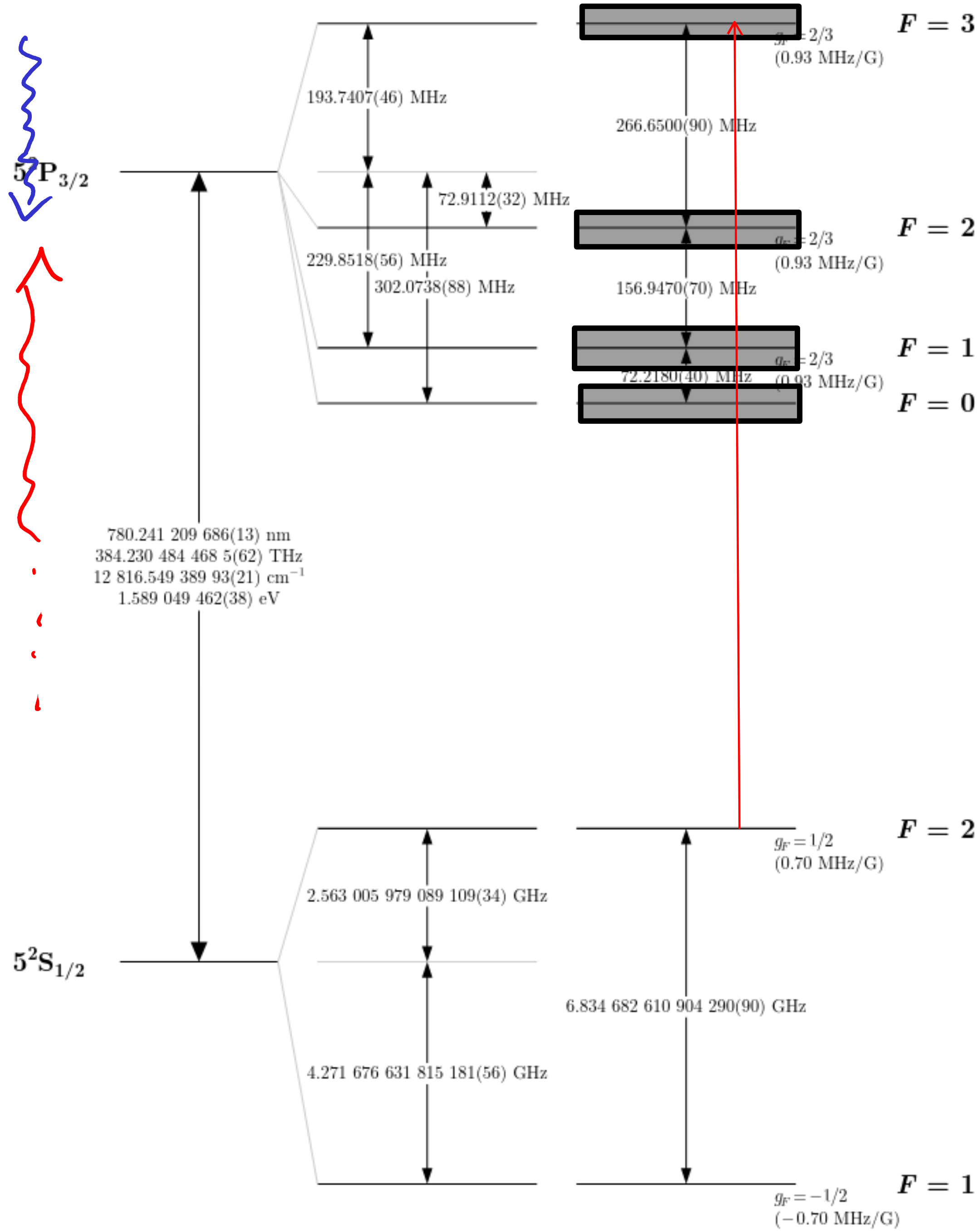
$$0 = \delta_{res} + \delta^{480} + \delta^{780}$$

$$\delta = \omega_{780} + \omega_{480} - \omega_{01} - \omega_{12}$$



$$T_D = \frac{\hbar \Gamma}{2 k_B}$$

$\Gamma \approx 6\,\mathrm{MHz}$



obtienes $F(x,v)$ usando qutip para obtener $\rho(t\to\infty, x, v)$ y así calcular $\vec{F}$

def $F(x,v)$:

llamar qutip

steadystate

$$\frac{d\vec{y}}{dt} = \vec{f}(t, \vec{y})$$

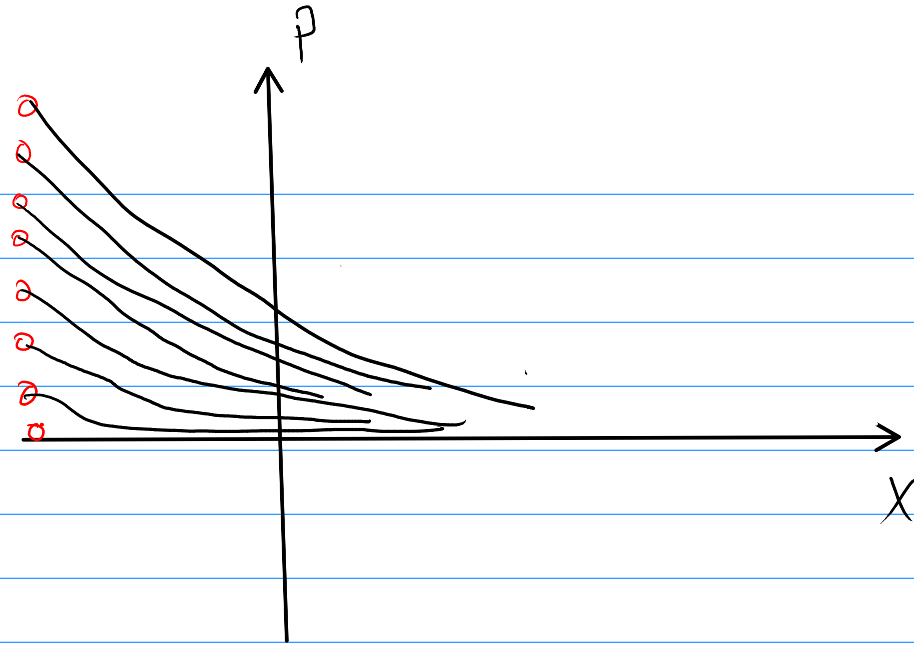
$$F(x(t), v(t)) = m\ddot{x}(t)$$

$$V = \dot{x}$$

$$\dot{V} = \ddot{x} \qquad \vec{y} = \begin{pmatrix} x \\ v \end{pmatrix}$$

$$\frac{1}{m}F(x(t), V(t)) = \dot{V}(t)$$

$$\frac{d\vec{y}}{dt} = \begin{pmatrix} \dot{x} \\ \dot{v} \end{pmatrix} = \begin{pmatrix} v \\ \frac{1}{m}F(x,v) \end{pmatrix} = f(\vec{y})$$


P
X