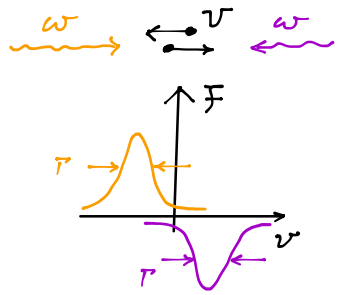
Lecture 9 Toward Bose-Einstein condensation 10/26/2021

Doppler cooling



$\Delta \equiv \omega - \omega_0 < 0$

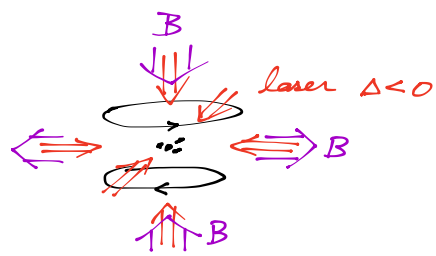
ignore recoil

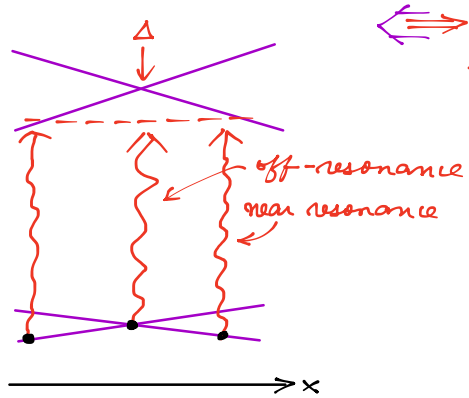
$\Delta(v) = \omega - \omega_0 - 2\frac{k}{2m}\cdot v$

$= 0$ when $\frac{k}{m}\cdot v = \Delta$

- Linear damping $F = -\beta v$ for small velocity
- Capture range $\frac{k}{m}v = \Delta \pm \Gamma/2 \Rightarrow v = \frac{m}{k}(\Delta - \Gamma/2) \cdots \frac{m}{k}(\Delta + \Gamma/2)$

Magneto-optical trap





Both trapping (spatical confinement) and cooling (momentum confinement).

Example: ^{87}Rb.

— 5p $S=1/2$ $L=1$ $i=3/2$ $J=1/2, 3/2$ (D_1, D_2) $F = 1,2,3$ (D_2 line), $1,2$ (D_1 line)

— 5s $S=1/2$ $L=0$. $i=3/2$. $F=1,2$