

Chapter 11. Atomic Spectroscopy

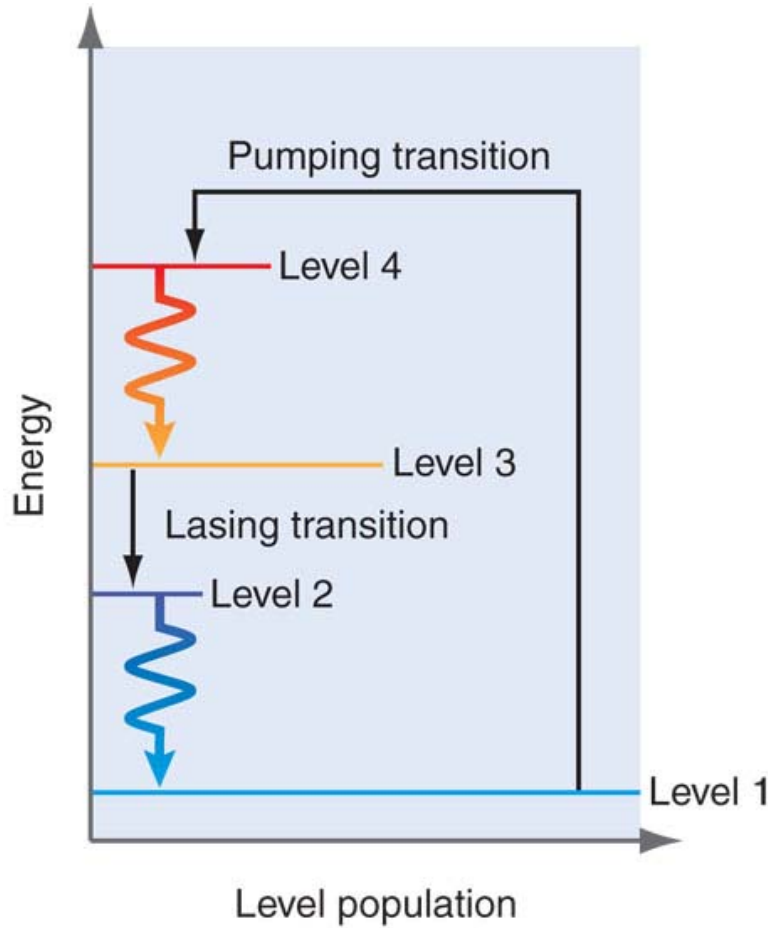
If L , S are good quantum #s

$$\Delta L = 0, \pm 1, \quad \Delta J = 0, \pm 1, \quad \Delta S = 0, \quad \Delta \ell = \pm 1 \quad \longleftarrow \quad \text{selection rules}$$

H atom $n = 1 \rightarrow 2, 3, 4, \dots$ Lyman
 $n = 2 \rightarrow 3, 4, 5, \dots$ Balmer
 $n = 3 \rightarrow 4, 5, \dots$ Paschen

He $1s^2 \rightarrow 1s2p(^1P)$ allowed
 $1s2s(^1S), 1s2s(^3S), 1s2p(^3P)$ forbidden

Atomic emission spectroscopy: can detect states with $n_{upper}/n_{lower} < 10^{-10}$

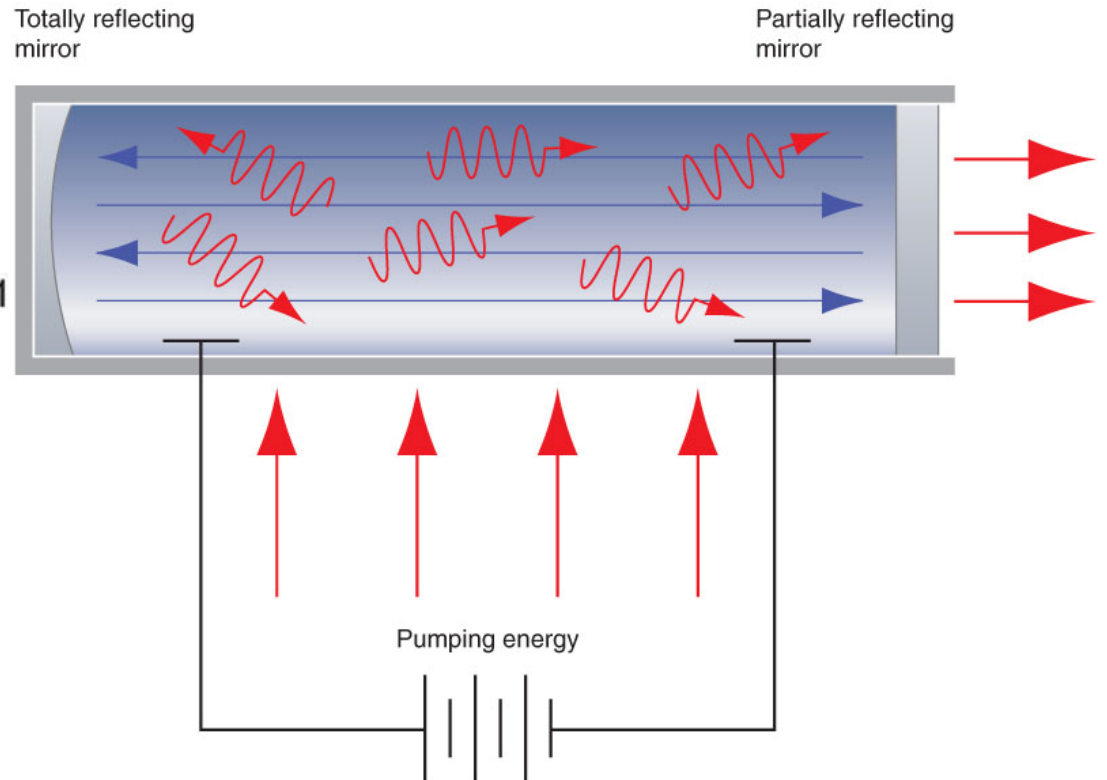


He Ne Laser

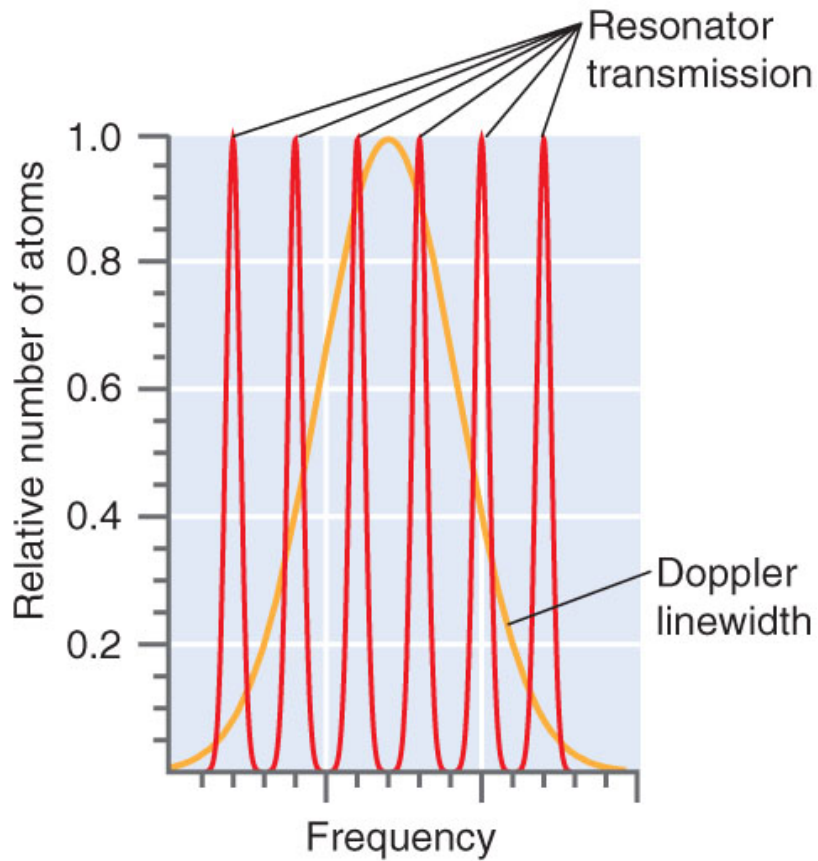
Pump *via* electrical discharge

If $k_{12} \gg k_{23}$, $N_3 \gg N_2 \rightarrow$ population inversion

Place in an optical resonator

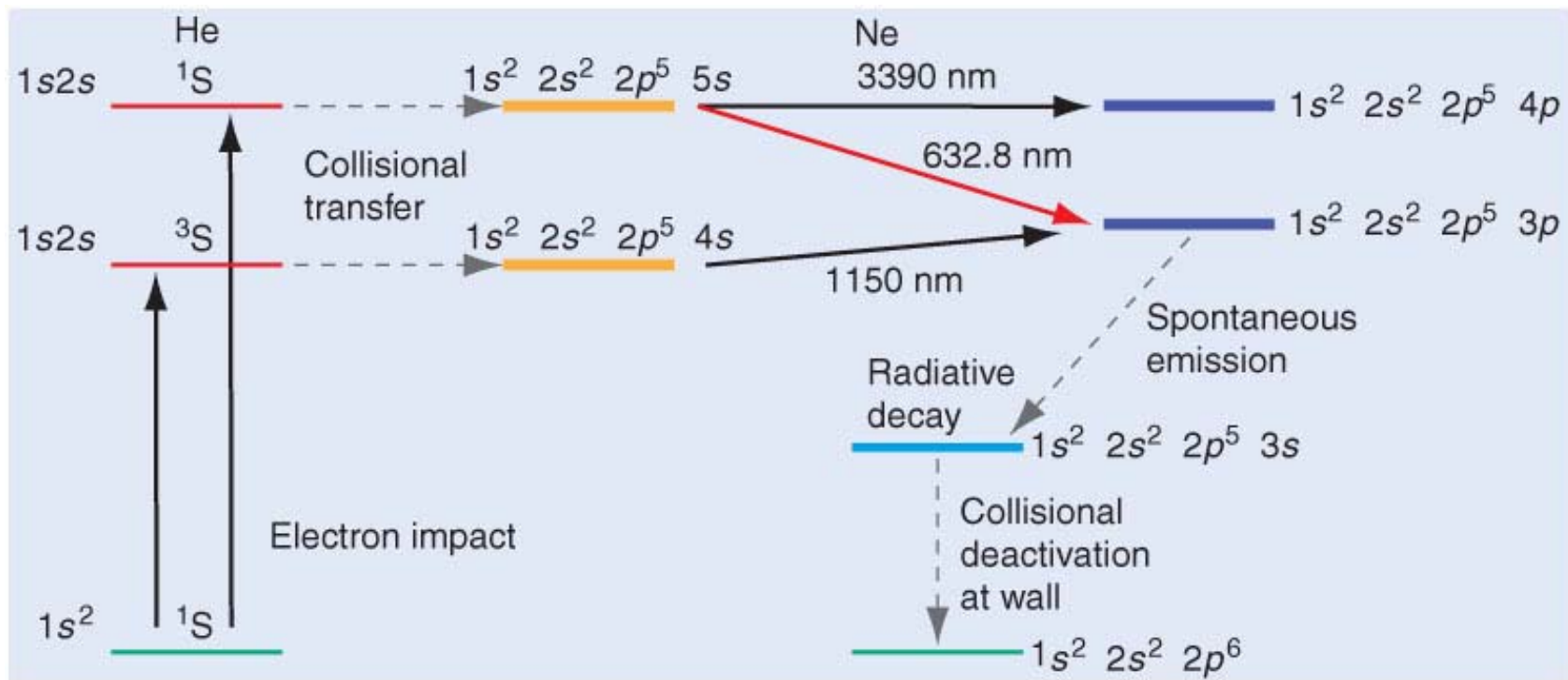


constructive
interference $h\lambda = n\left(\frac{c}{\nu}\right) = 2d$



By use of amplification and filters, can limit the # of active modes to one.

(a)



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632.8 nm line → red light

Auger spectroscopy: →

x-ray photoelectron spectroscopy

energies of levels depends on chemical environments

