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- 10 mW of laser power.
- focused down to 10 μm.
- Detuning: $\delta = -2\pi \times 100$ GHz.

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$$\Delta E = \frac{\hbar}{4}\frac{\Omega^2}{\delta} \quad \text{with} \quad \Omega = \frac{q_e \langle g | r | e \rangle \cdot E}{\hbar}$$

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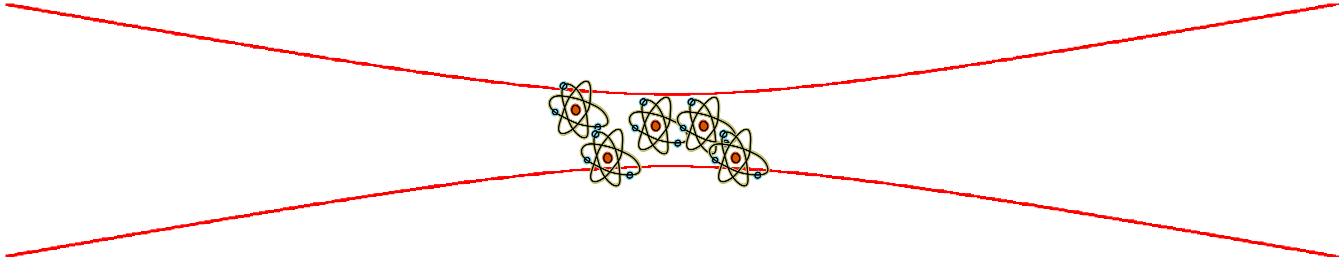

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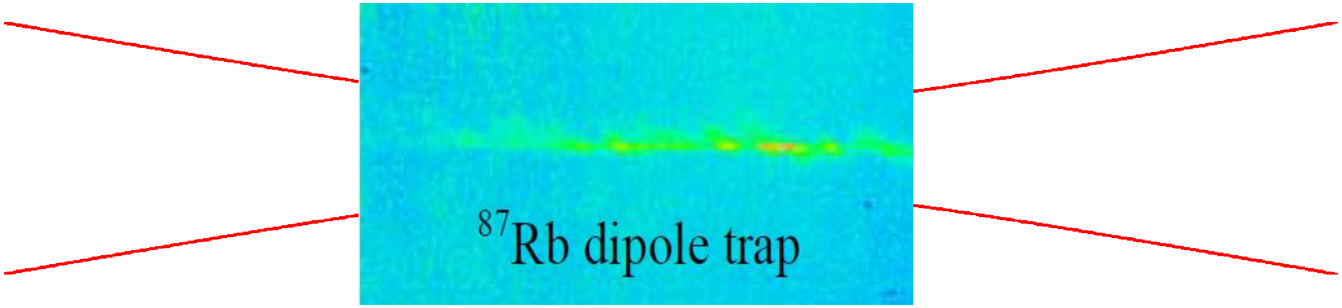
Atoms are trapped by focused laser light !!!



Laser Dipole traps

Quasi-static Limit:

- 1 W of power.
- focused down to 100 μm.

Atom: ^{87}Rb

DC polarizability: $\alpha = h \cdot 0.08\ Hz/(\frac{V}{cm})^2$

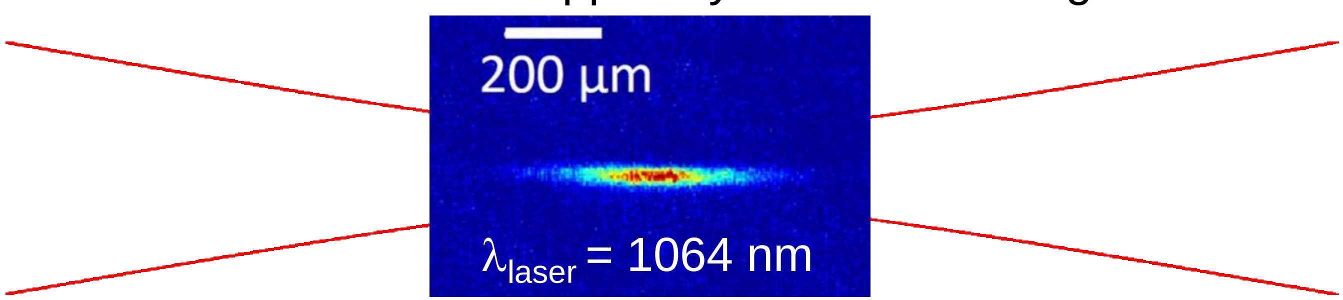
$\Rightarrow$ Intensity ~ 10^8 W/m^2, Electric field = 2.7×10^3 V/cm

U = -1.2×10^{-28} J

~ 10 μK !!!

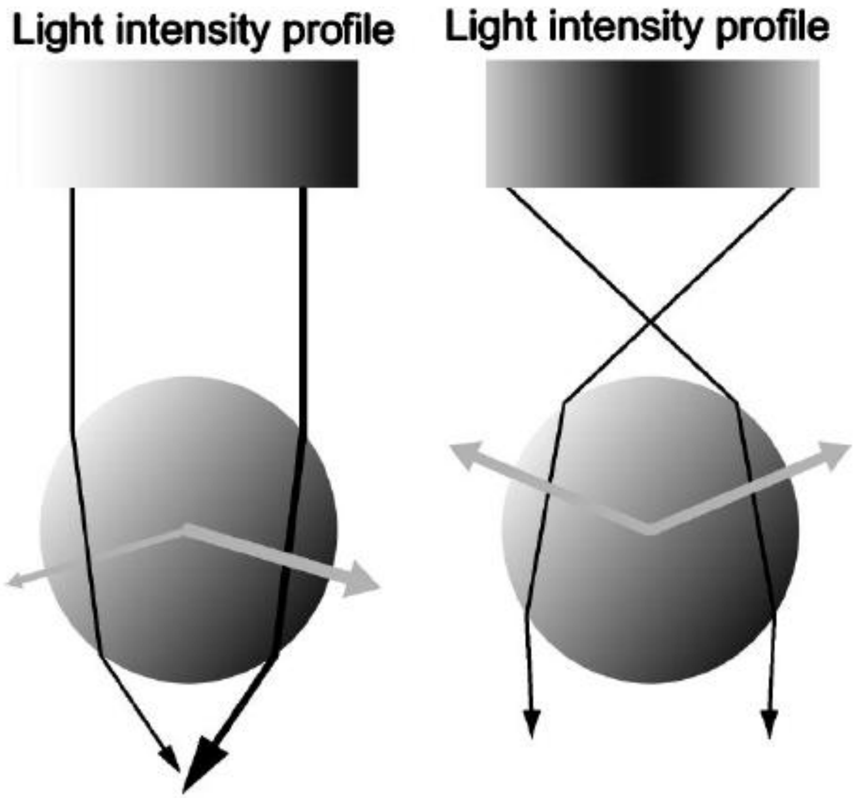
$\Rightarrow$ v ~ 3 cm/s

Ultracold atoms are trapped by focused laser light !!!



Optical Tweezers

The classical picture of dipole trapping is given by ray optics:



Sphere attracted to region of high intensity.

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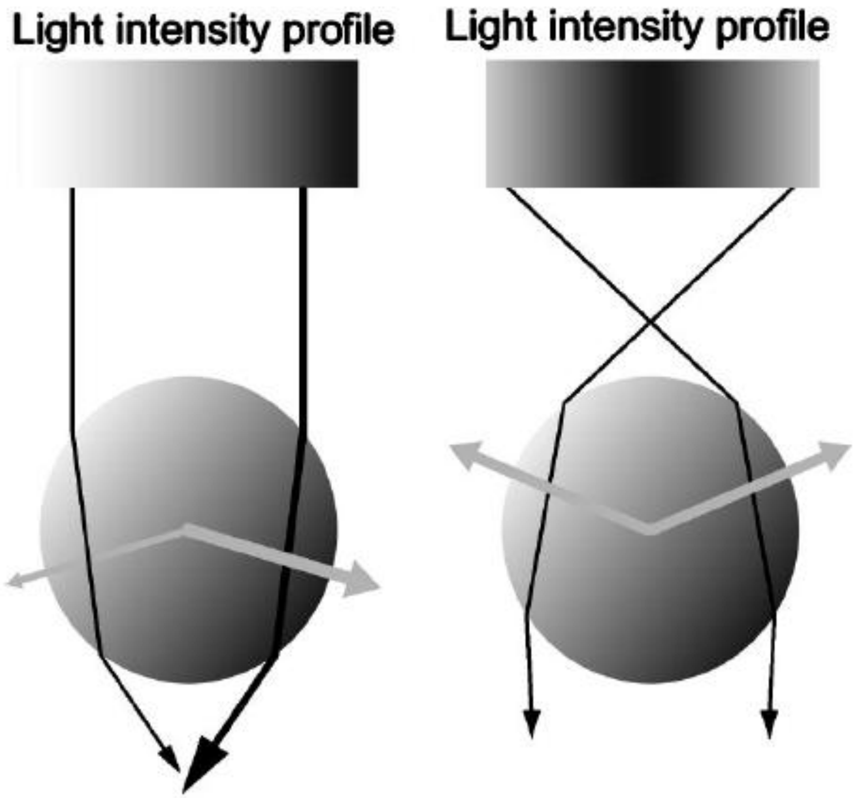
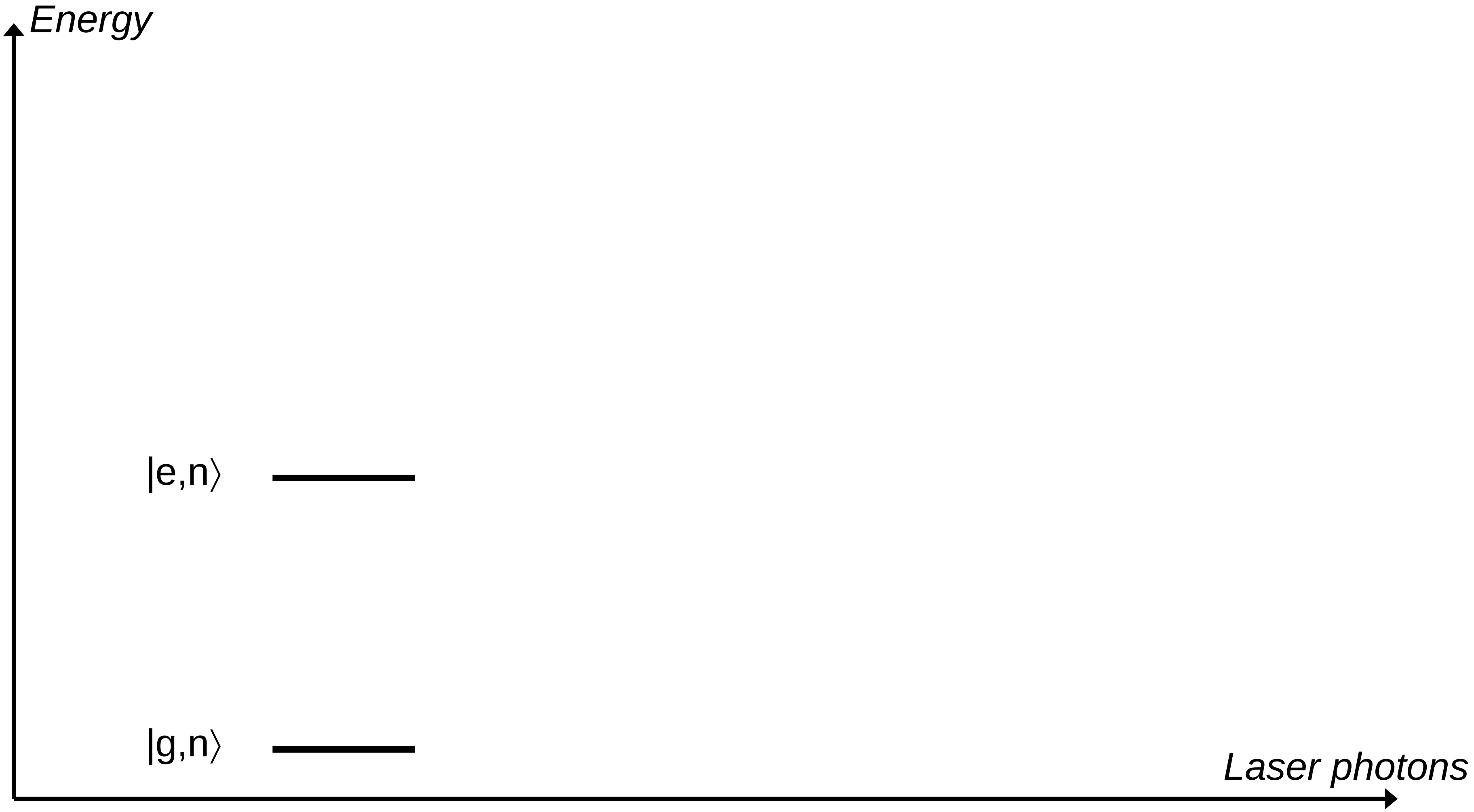


Frequently used in biophysics to manipulate cells !!!

Sphere attracted to region of high intensity.

Mollow Triplet (I)

Atom + Laser Field (dressed atom picture), δ=0



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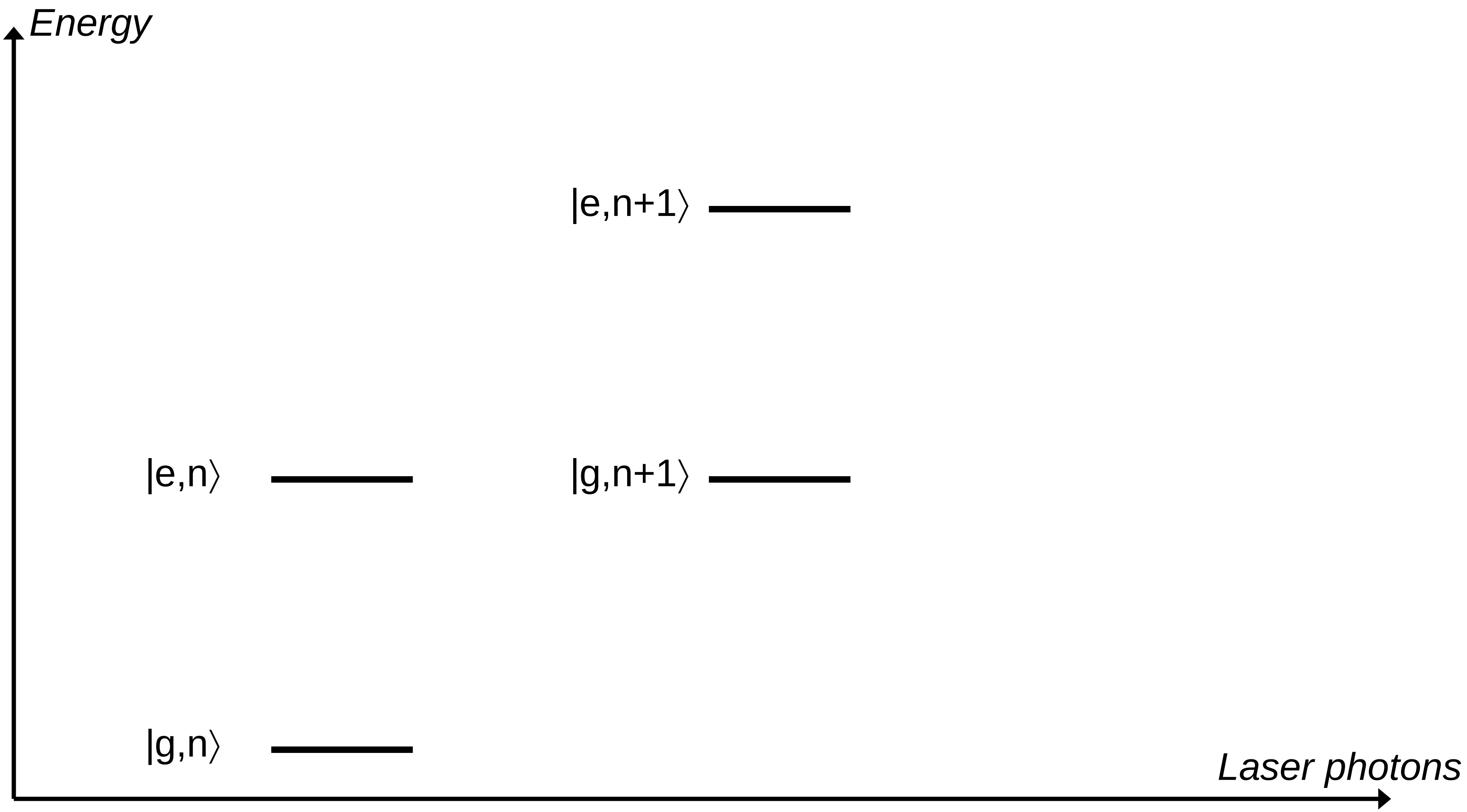

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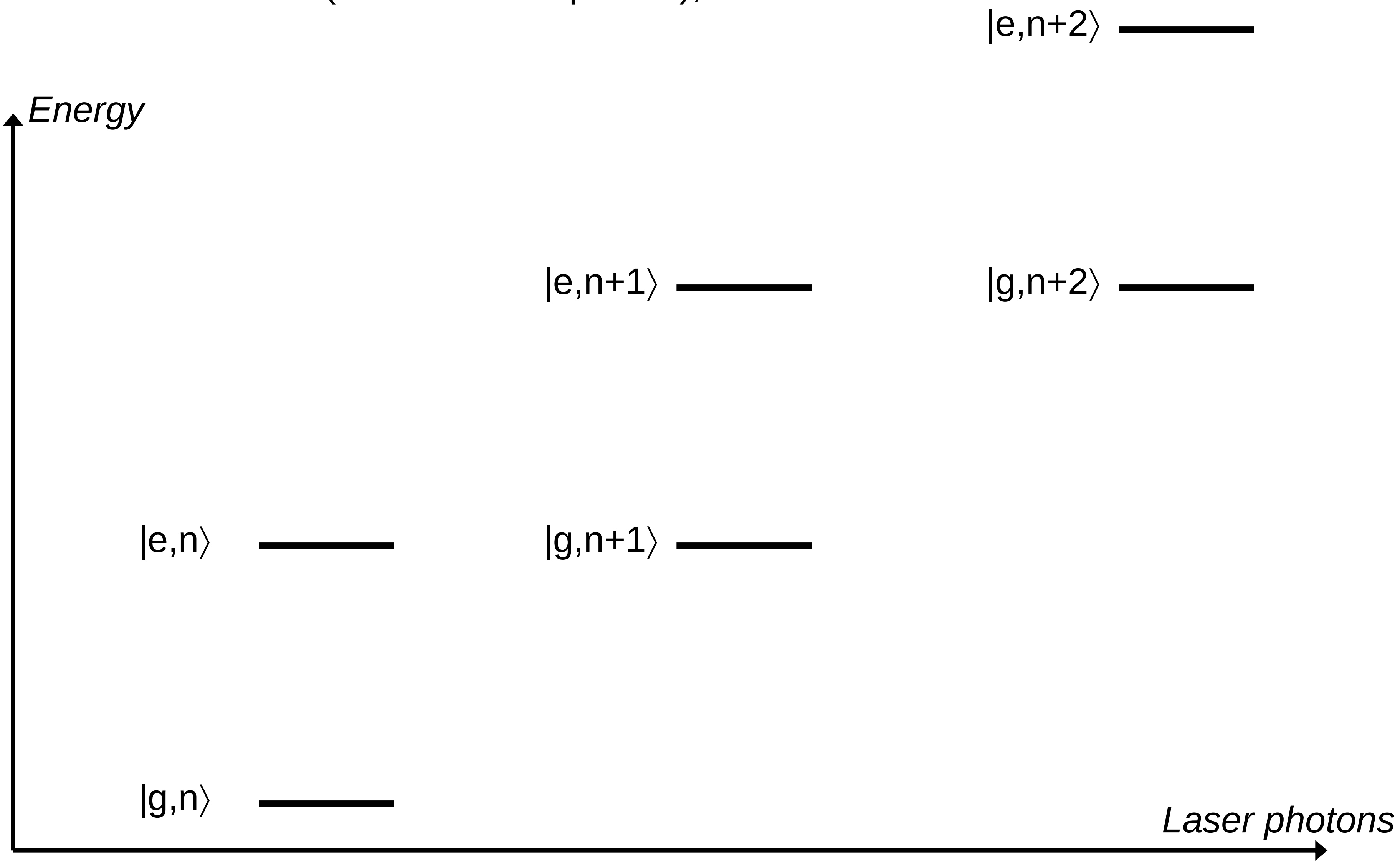
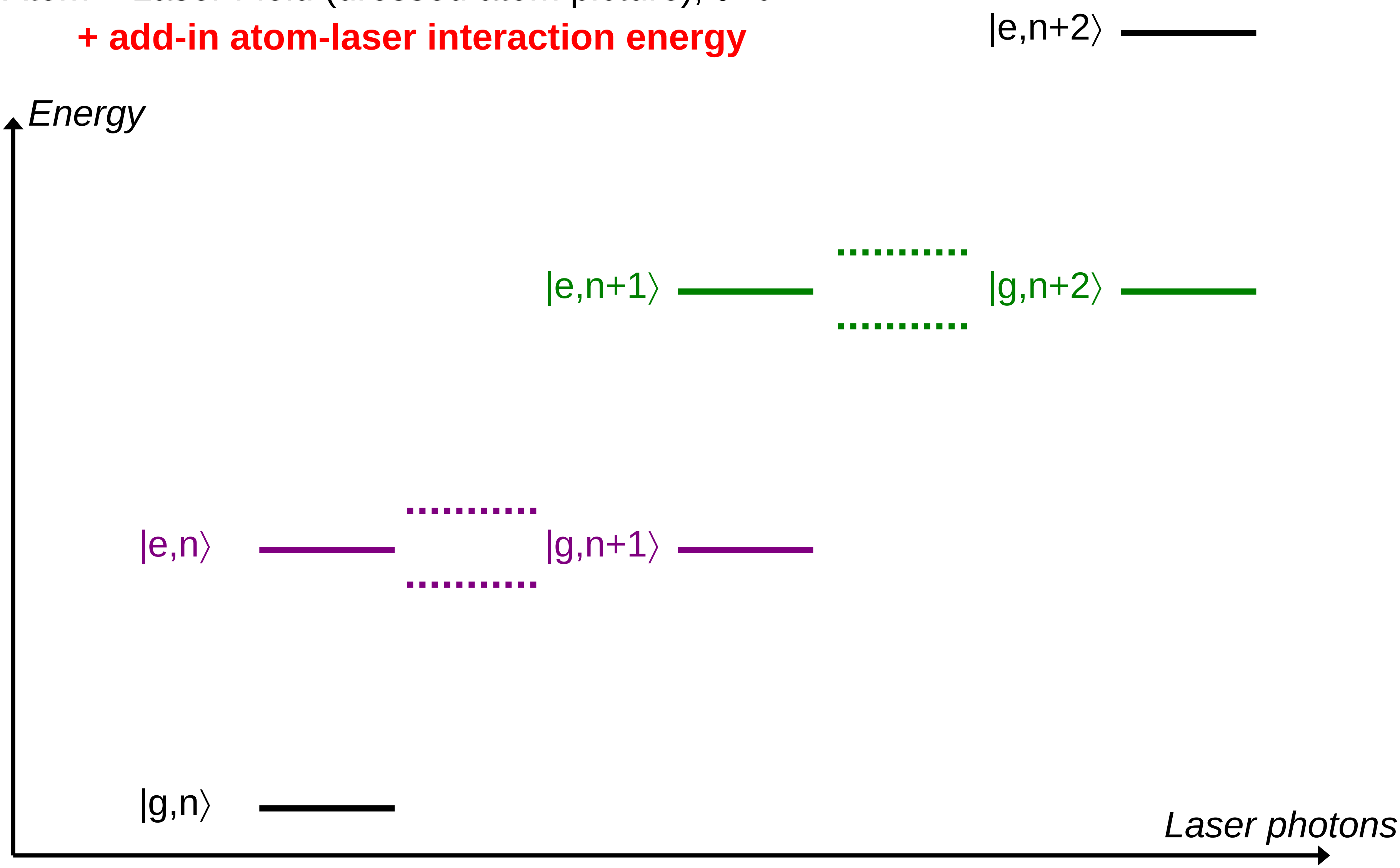


Mollow Triplet (II)

Atom + Laser Field (dressed atom picture), δ=0

+ add-in atom-laser interaction energy



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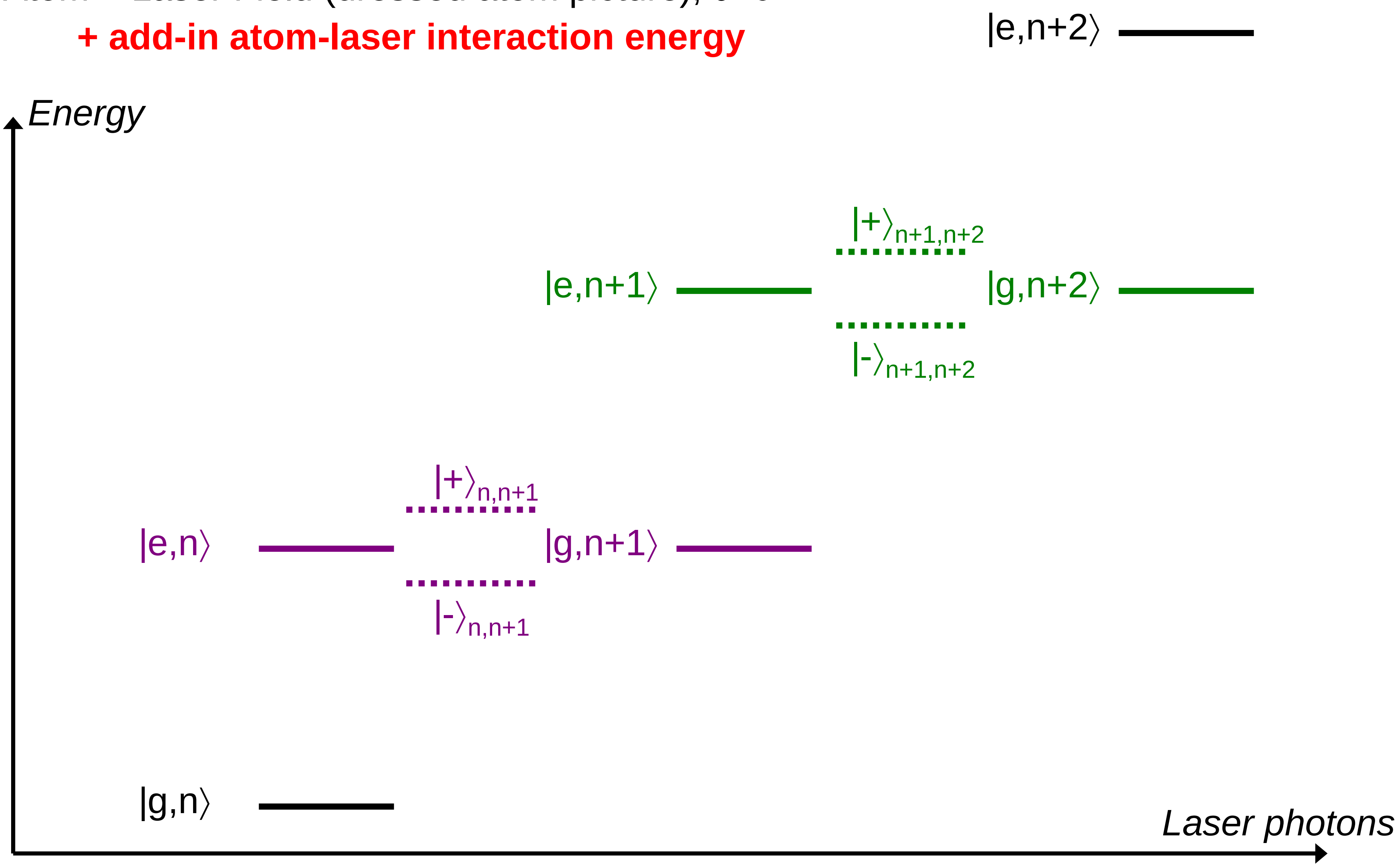

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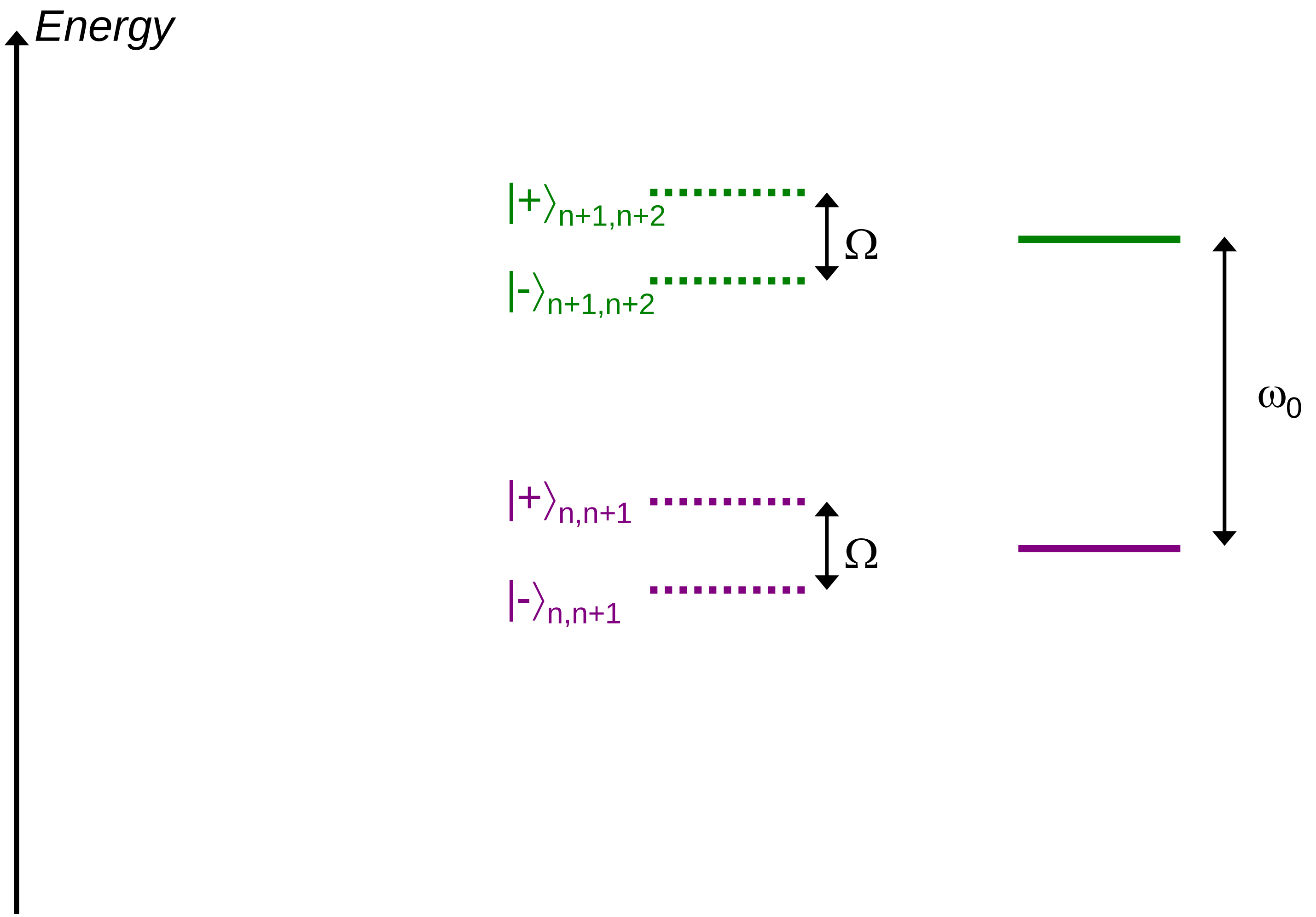

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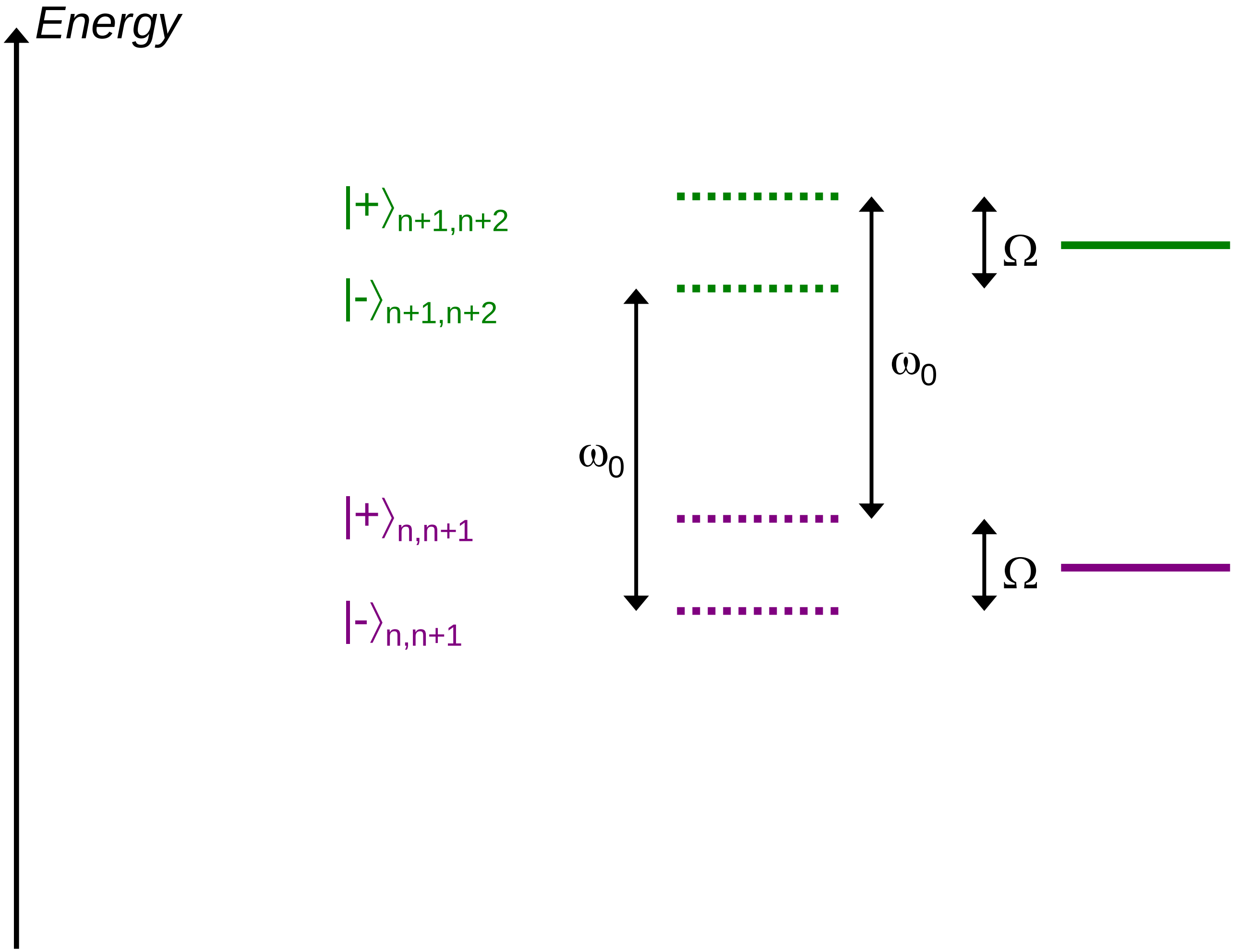

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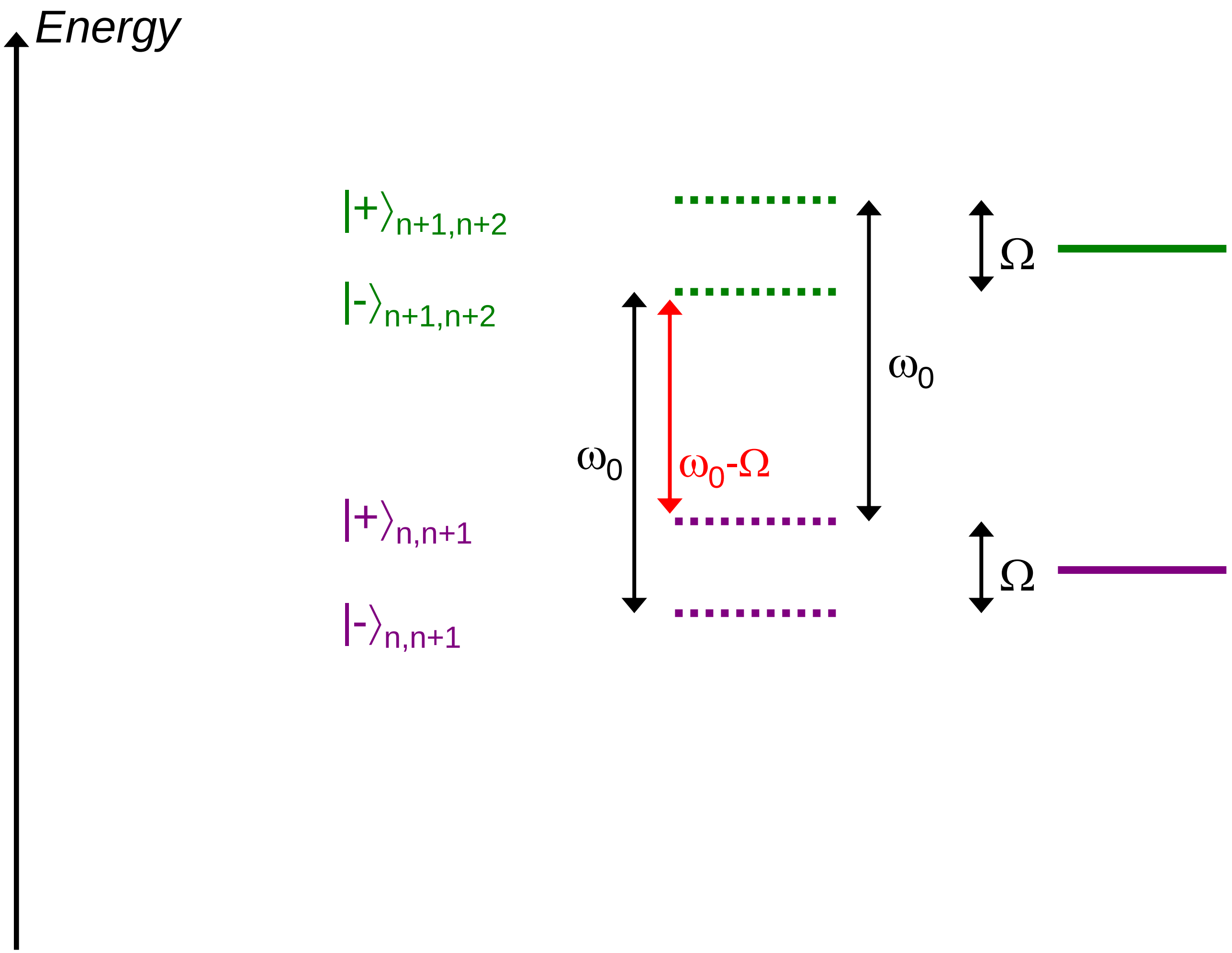

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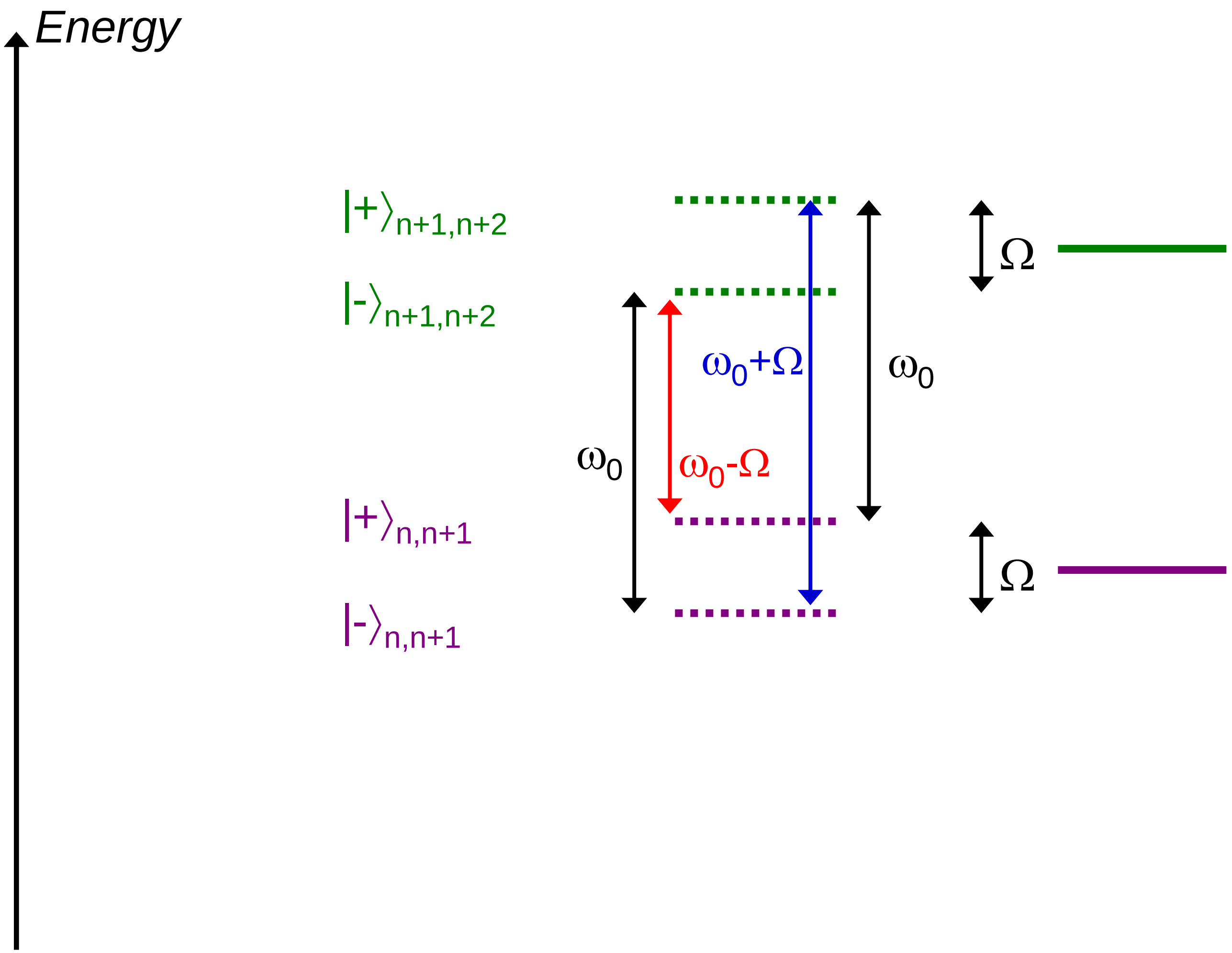
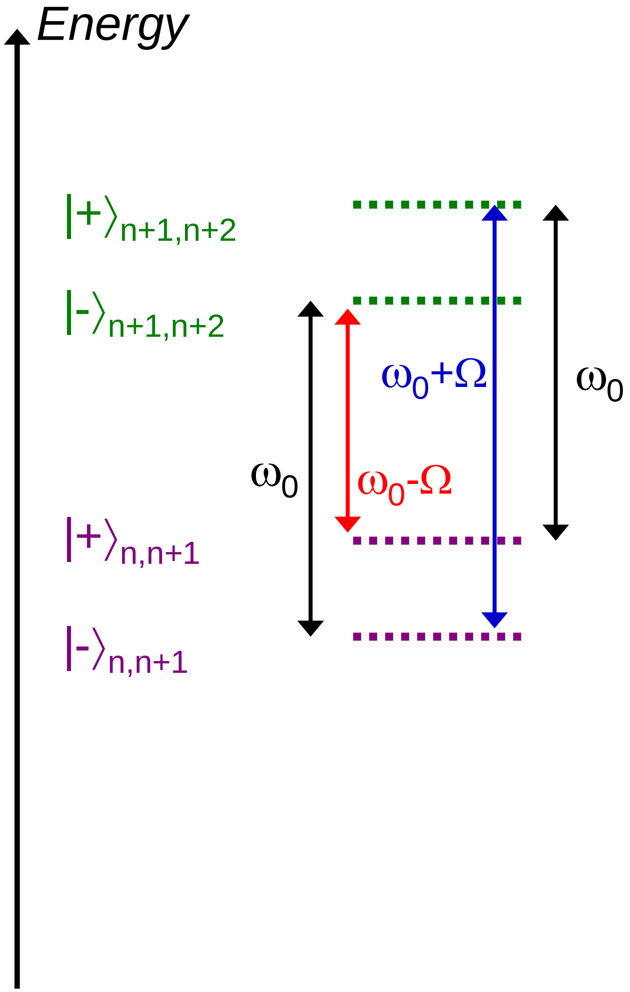
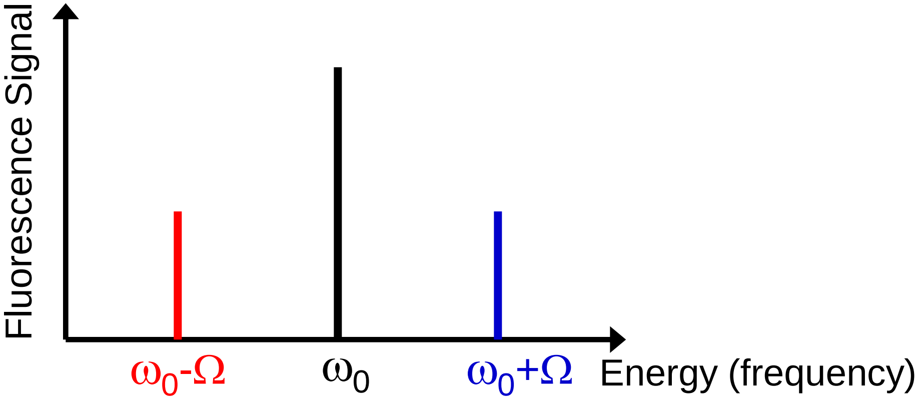


Mollow Triplet (III)

Atom + Laser Field (dressed atom picture), δ=0

+ add-in atom-laser interaction energy





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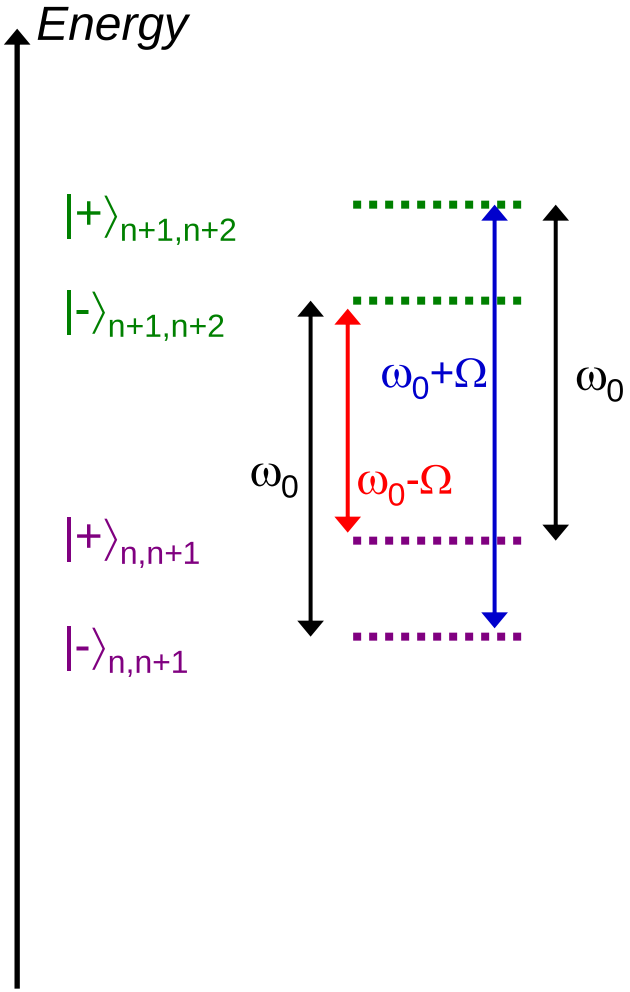
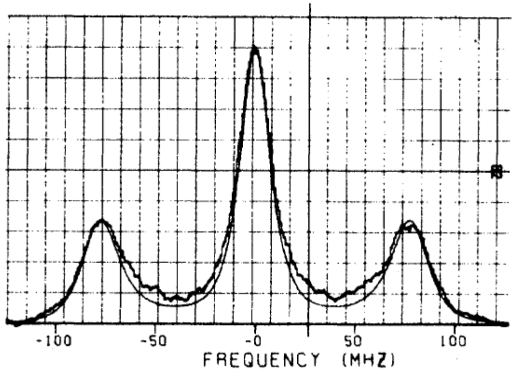


Mollow triplet in Sodium at 589 nm



[Grove et al., Phys. Rev. A 15, 227 (1977)]