

February 23, 2005

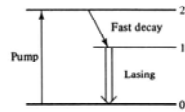
■ **Exam #1: Results!**

- **Range:** 62 - 186
- **Average:** 139.1/200 (70%)
- **Median:** 139/200

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Population Inversion

- Requires at least a **3-state system**:



• **PUMP** so that  $N_1 > N_0$   
(population inversion)

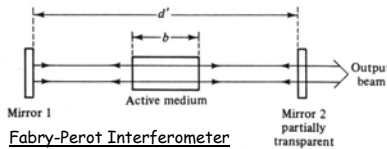
Pumping Methods:

- **Optical** - flashlamp, laser
- **Electrical** - capacitive electrical discharge
- **Chemical** - reaction leaving product in excited state

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Optical Amplification

- We can enhance the **intensity** of the emission by using an **optically resonant cavity**:

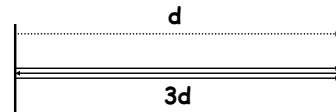


Get constructive interference if:  $d' = n\lambda/2$

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Constructive Interference

- Waves are **perfectly in-phase** if the difference in the distance they travel is an **integer multiple of the wavelength**:



$$3d - d = 2d = n\lambda$$

$$d = n\lambda/2$$

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EMR from a Laser is *Unusual*

- **Spatial Coherence**
  - all photons are *in-phase*
  - can attain very high *power density*
  - very low *beam divergence*
- **Spectral Coherence**
  - highly monochromatic
- **High-Intensity**
  - very high power over very small  $\Delta\lambda$

Very rarely used for *absorption spectrophotometry*, but important sources for *fluorescence and Raman spectroscopies*

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