

# February 18, 2005

➤ **No Class on Monday** (Presidents Day)! ☹

➤ **Exam #1**

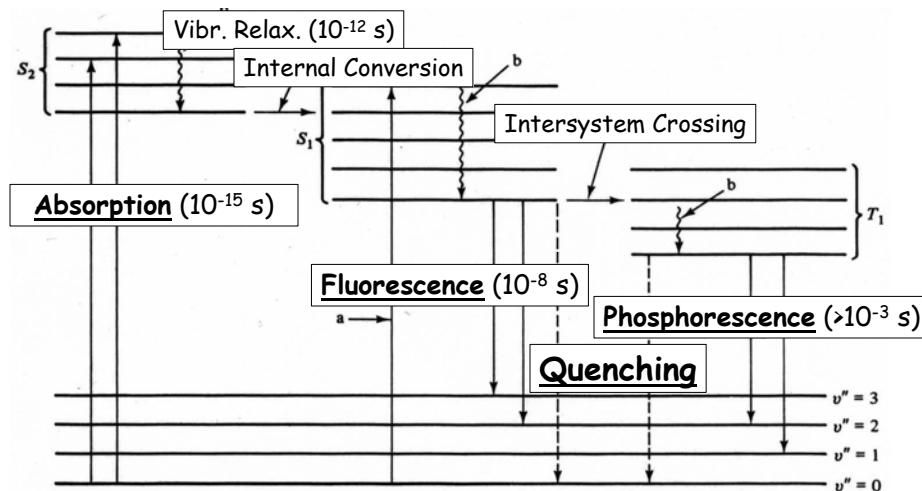
- Solution Key will be posted soon
- Graded Exams returned next Wednesday

➤ **Who Was Jablonski?**

- Alexander Jablonski (1898-1980)
  - "The Father of Fluorescence Spectroscopy"
  - <http://micro.magnet.fsu.edu/optics/timeline/people/jablonski.html>

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## Jablonski Diagram

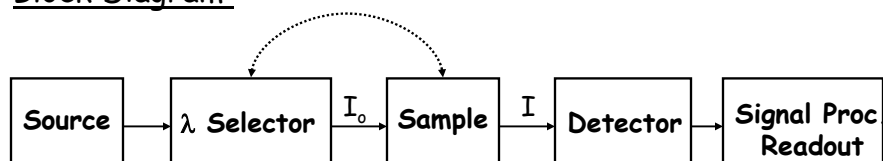


# Spectroscopy: Instrumentation

Chem 221  
Instrumental Analysis  
Spring 2005

## Spectrometer Configuration

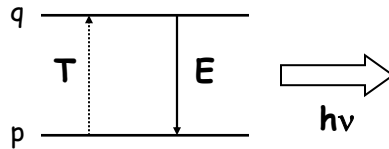
Block Diagram:



- Continuum
- Line
- Dispersive
- Non-Dispersive
- Liquids
- Gases
- Solids
- Single-Channel
- Multi-Channel

# Line Sources

- Most line sources rely on *spontaneous emission* from *thermally-excited gas-phase* atoms/ions:



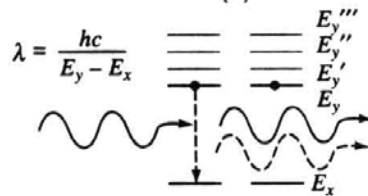
Emission rate = 
$$-dN_q/dt = N_q A_{qp}$$

Excited state population

Einstein Spontaneous Emission Transition Probability

# LASERs: The *Ultimate* Line Sources

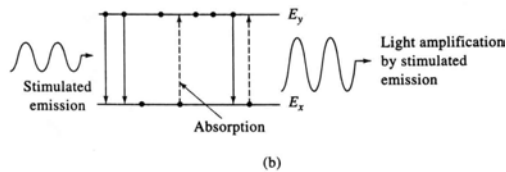
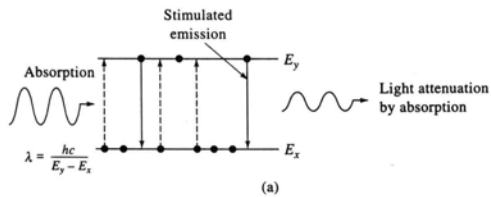
- Based on *Stimulated Emission*:



Light **A**mplification by **S**timulated **E**mission of **R**adiation

# Absorption versus Stimulated Emission

- Two processes can occur when a system is presented with EMR:



Since:

$$B_{pq} (\text{Abs}) = B_{qp} (\text{St. Em.})$$

-rates of absorption and of stimulated emission depend on the *populations* of the *ground* ( $N_p$ ) and *excited* ( $N_q$ ) states, respectively

Need:  $N_q > N_p$   
(population inversion) . .

**Impossible!** (with just 2 states)