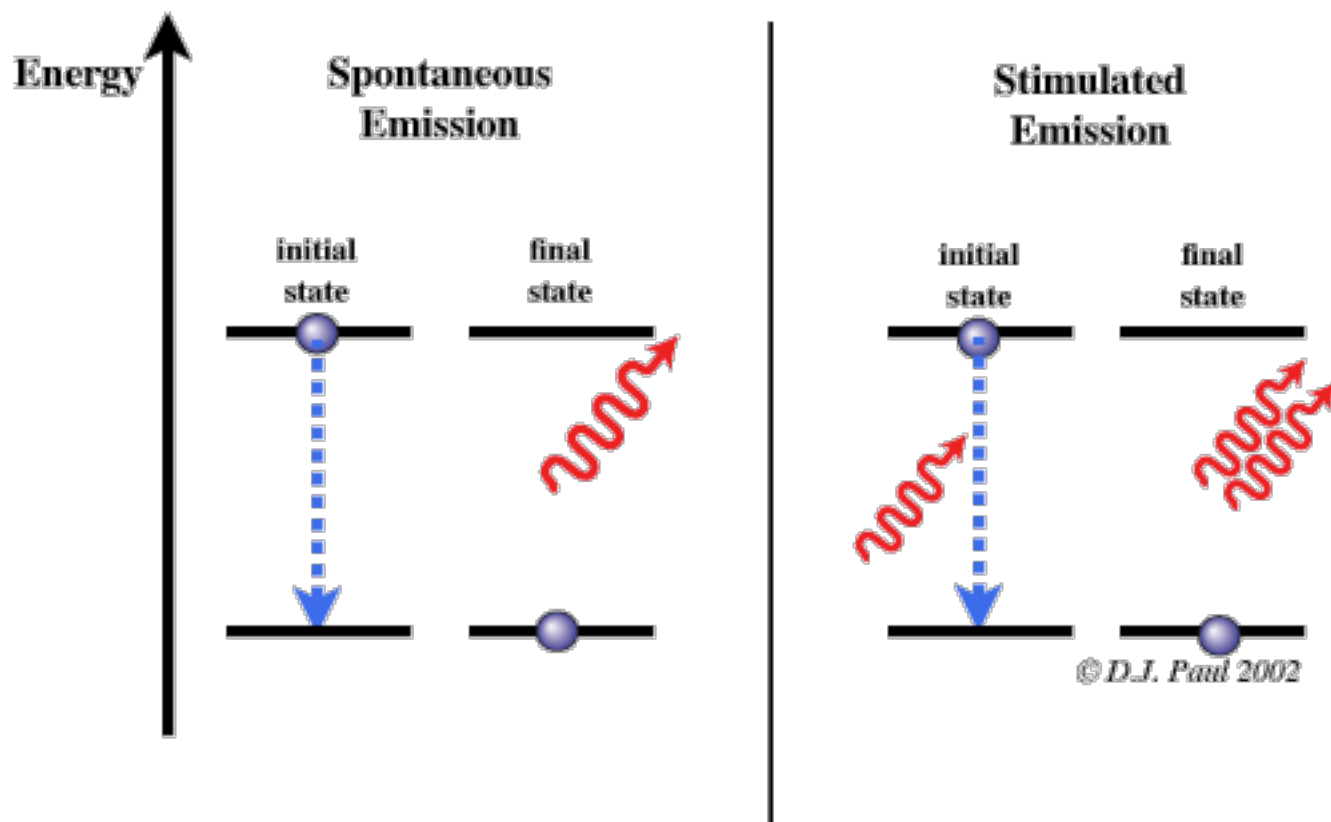
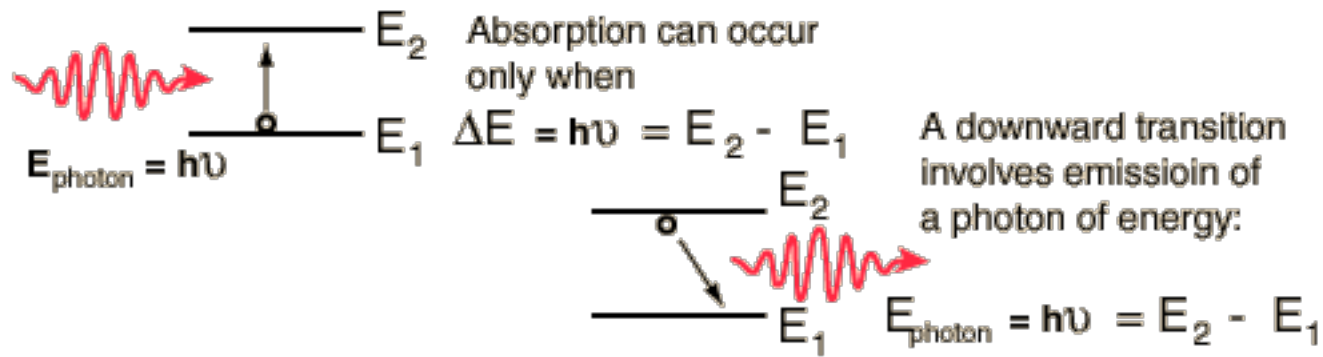


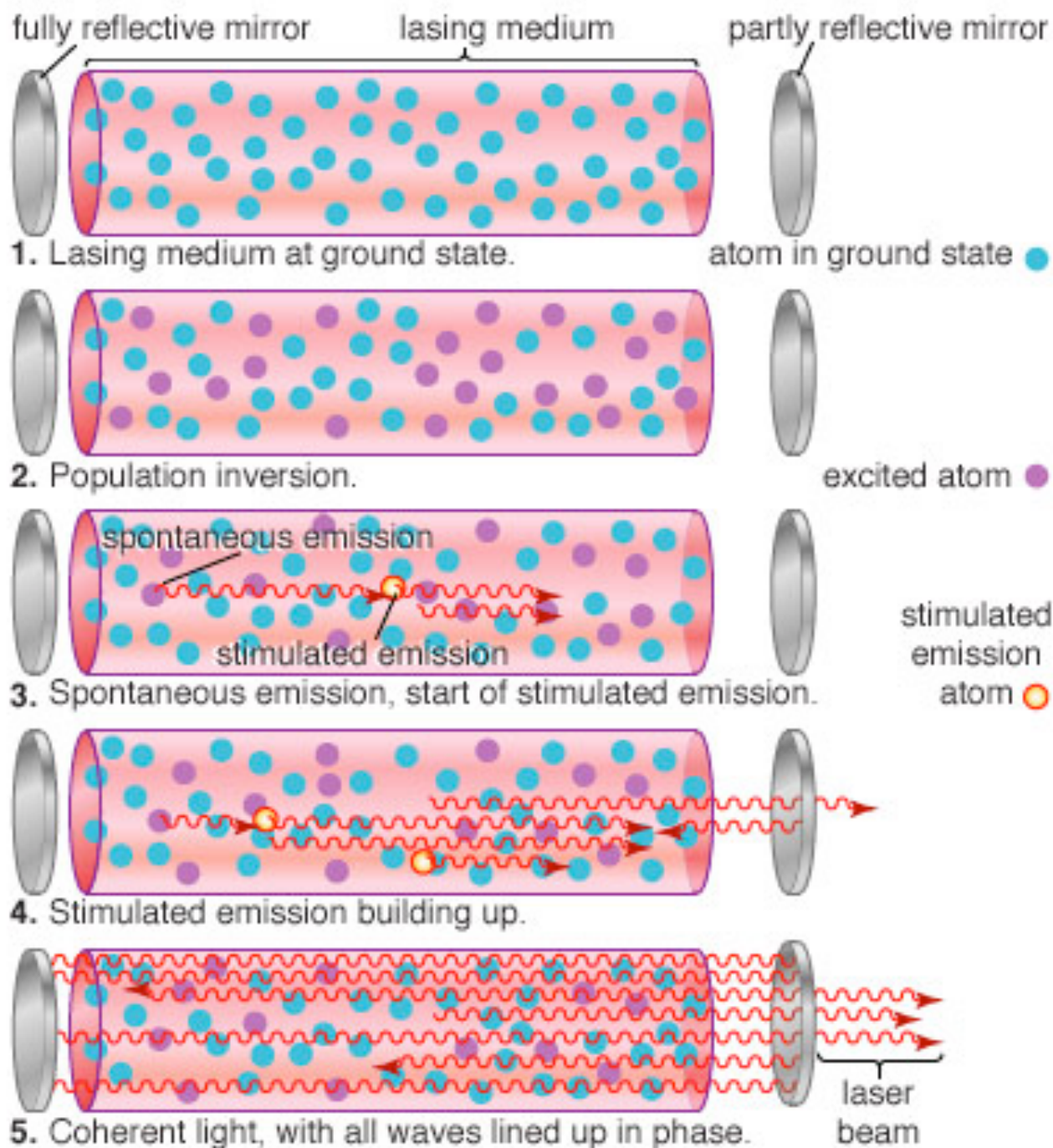
PHY385-H1F Introductory Optics

Class 15 – Outline: Section 13.1

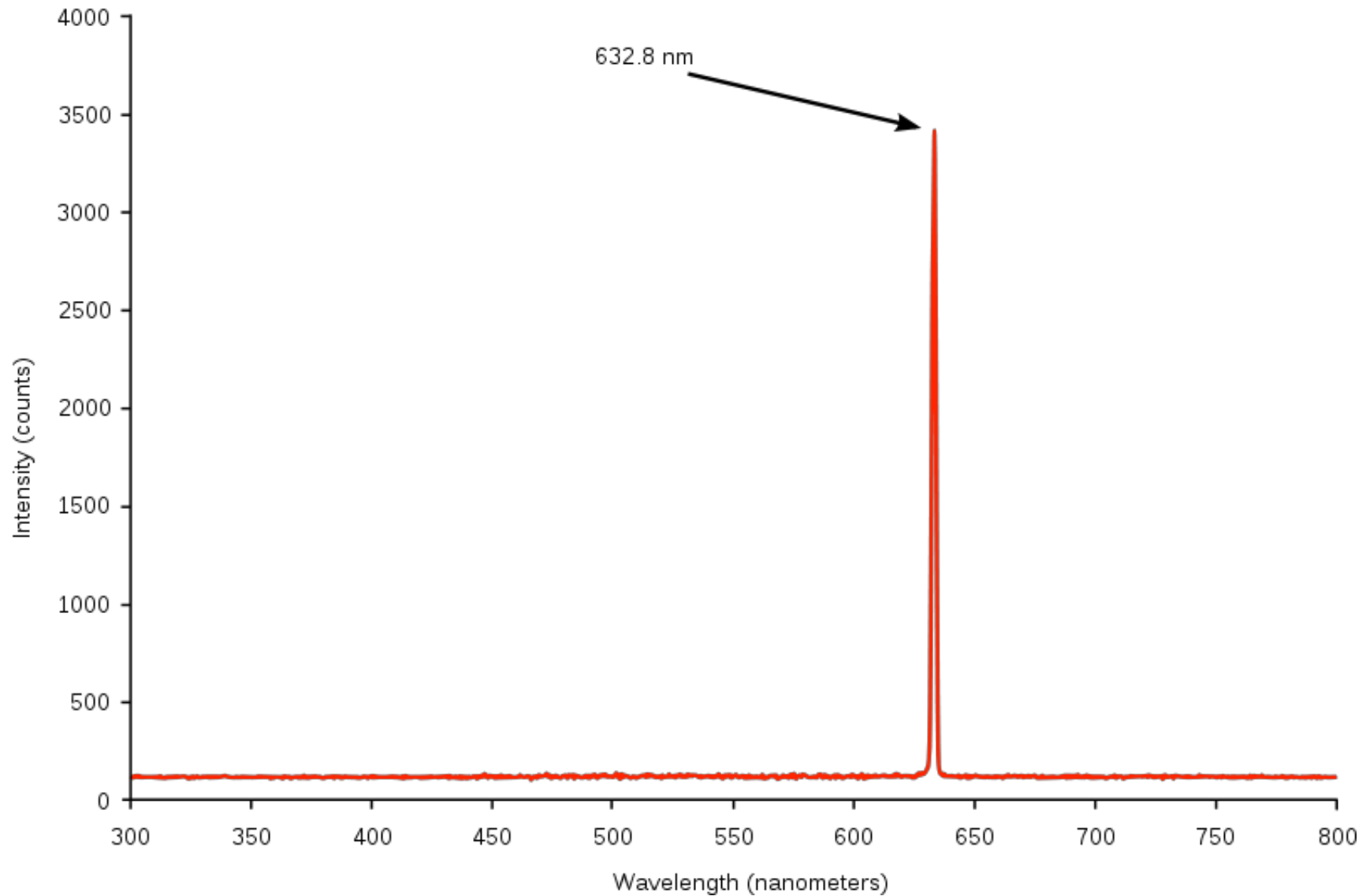
- Population of Electron Energy Levels
- Einstein A and B Coefficients
- Gas Laser; HeNe
- Optical Resonant Cavities
- Transverse Modes
- Gaussian Beams
- Properties of Laser Light
- The Diode Laser



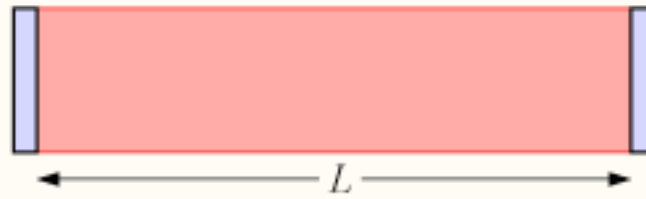




Spectrum of a He-Ne Laser



$R_1 = \infty$ *plane-parallel* $R_2 = \infty$



$R_1 = L/2$ *concentric (spherical)* $R_2 = L/2$



$R_1 = L$ *confocal* $R_2 = L$



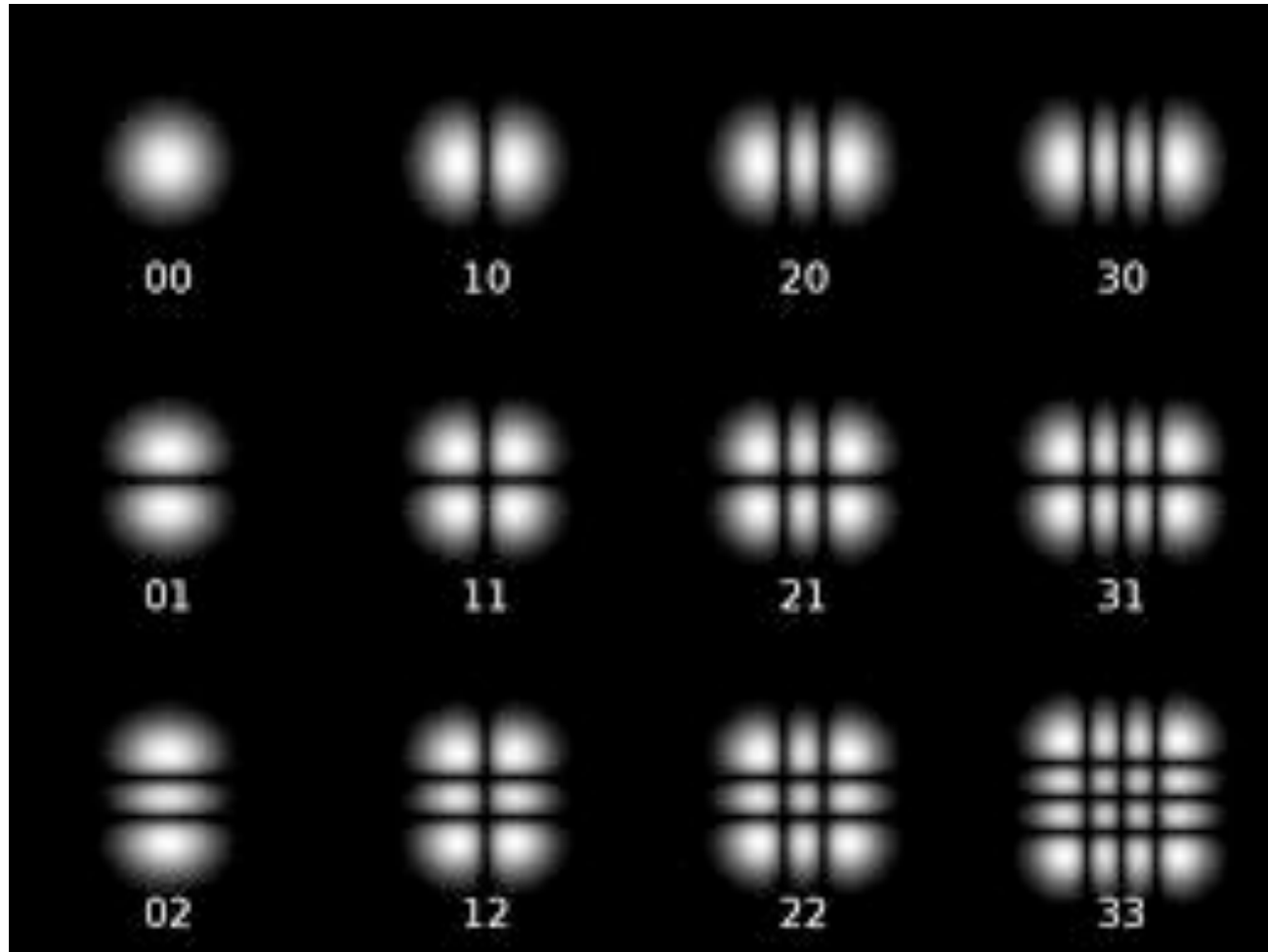
$R_1 = L$ *hemispherical* $R_2 = \infty$



$R_1 > L$ *concave-convex* $R_2 = L - R_1$



Transverse Modes



Laser uses for power outputs

- less than 1 mW – laser pointers
- 5–10 mW – DVD player or DVD-ROM drive
- 100 - 250 mW – Consumer DVD-R burner
- 1–20 W – output of the majority of commercially available solid-state lasers used for micro machining
- 30–100 W – typical sealed CO₂ surgical lasers
- 100–3000 W – typical sealed CO₂ lasers used in industrial laser cutting
- > 3 kW – Pulsed lasers

Laser Safety

- **Class 1** is inherently safe, usually because the light is contained in an enclosure, for example in CD players.
- **Class 2** is safe during normal use; the blink reflex of the eye will prevent damage. Usually up to 1 mW power, for example laser pointers.
- **Class 3a** lasers are usually up to 5 mW and involve a small risk of eye damage within the time of the blink reflex. Staring into such a beam for several seconds is likely to cause (minor) eye damage.
- **Class 3b** can cause immediate severe eye damage upon exposure. Usually lasers up to 500 mW, such as those in CD and DVD writers.
- **Class 4** lasers can burn skin, and in some cases, even scattered light can cause eye and/or skin damage. Many industrial and scientific lasers are in this class.