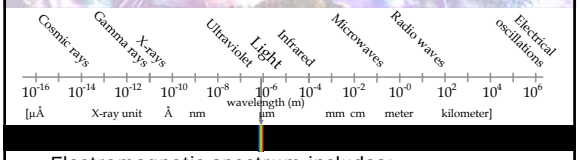
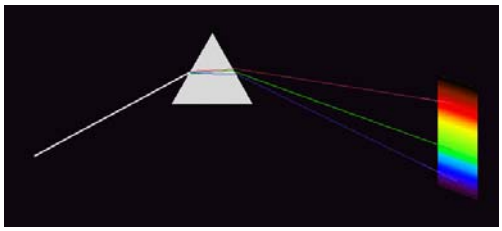
Visible Light in EM Spectrum



- Electromagnetic spectrum includes:
  - cosmic rays
  - X rays
  - ultraviolet light
  - infrared radiation
  - microwaves
  - radio waves
  - ...

Visible Light

- Isaac Newton demonstrated that white light is composed of a spectrum of many colors in 1676



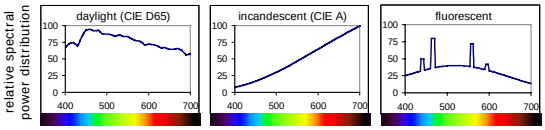
Optics: Rays and Waves

- Models of Action of Light
- Light as Ray (Simplest Model)
  - Use to locate images created by optical systems
- Light as Wave
  - Describe “quality” of images created by optical systems

Light Sources

Sources are described by *spectral power distributions*: measure of power emitted at each wavelength (color)

While humans adapt to each illuminant, white light includes energy across the "entire" spectrum



All three spectra perceived as "white"

Imaging Chain: Energy Source

- How is Light Generated?
  - Thermal emission = motion of atoms and molecules
    - Emits "broadband" radiation
      - incandescent lights
  - Atomic "transitions" = changes of state of electrons
    - emits or absorbs narrow bands of light
      - fluorescent lights
      - lasers
      - Light-emitting diodes (LEDs)

Imaging Chain: Energy Source

- Examples include:

- Sun (and other stars)
- Incandescent bulbs
- X-ray sources
- Ultrasound transducers
- Explosive charges
- Phosphors
- Fluorescent bulbs
- Excited gas (*e.g.*, neon)
- Electronic flash (strobe)
- Electroluminescent displays
- LEDs
- Bioluminescent animals
- Candles
- People
- Radio transmitters
- Arc (*e.g.*, carbon theatre lights)
- Toaster heating elements
- Radioactive materials
- Ultrasound transducer
- …