Astro110-01 Lecture 13
Light: The Cosmic Messenger
[Chapter 5 in The Essential Cosmic Perspective]
Basic Properties of Light and Matter

Our goals for learning:

• What is light?
• What is matter?
• How do light and matter interact?
Discovering the components of light
Light is an electromagnetic wave

Properties of a wave:
- Wavelength
- Frequency
- Speed
Wavelength, Frequency and Speed

\[ \text{wavelength} \times \text{frequency} = \text{speed of wave} \]

speed of light wave = constant = \(3 \times 10^8\) m/s
The Electromagnetic Spectrum

Inverse relationship between wavelength and frequency
Particles of Light

• Particles of light are called photons.
• Each photon has a wavelength and a frequency.
• The energy of a photon depends on its frequency.
Wavelength, Frequency, and Energy

\[ \lambda \times f = c \]

\( \lambda \): wavelength

\( f \): frequency

\( c \): speed of light = \(3.00 \times 10^8\) m/s

photon energy: \( E = h \times f \)

Planck’s constant: \( h = 6.626 \times 10^{-34}\) joule\( \cdot \)s
Thought Question

The higher the photon energy,

• the longer its wavelength.
• the shorter its wavelength.
• Energy is independent of wavelength.
Thought Question

The higher the photon energy,
• the longer its wavelength.
• **the shorter its wavelength**
• Energy is independent of wavelength.