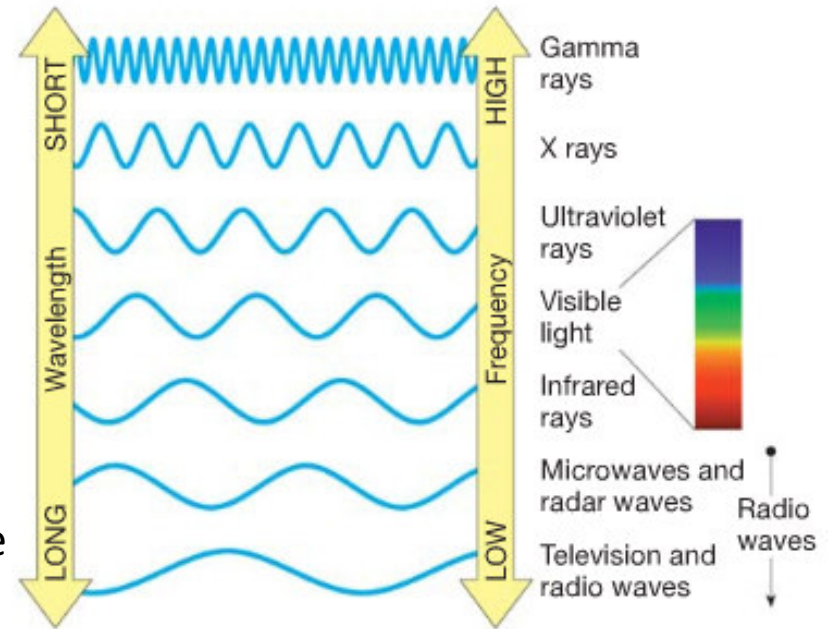


Ch 24.1 Studying the Sun

- Astronomers are in the business of gathering and studying light. Almost all we know about the universe is by analyzing light from distance sources.

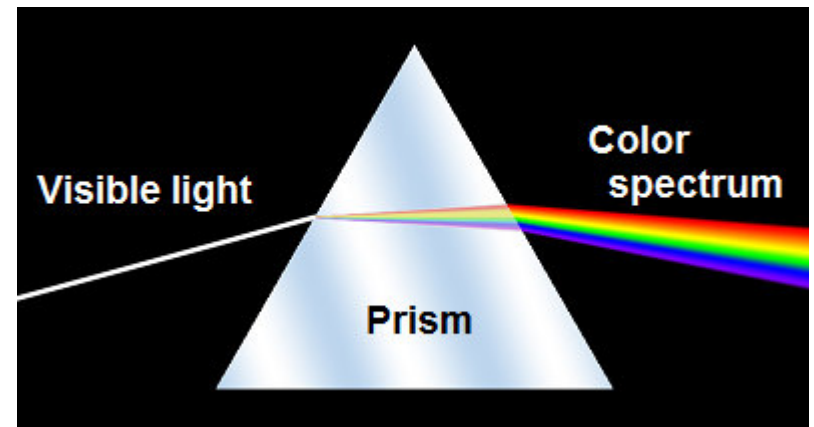
Electromagnetic Radiation

- By studying the light emitted from stars and other bodies in space gives us information.
- Electromagnetic radiation includes gamma rays, X-rays, ultraviolet light, visible light, infrared radiation, microwaves, and radio waves.
- Electromagnetic radiation is the arrangement of these waves according to their wavelengths and frequencies.

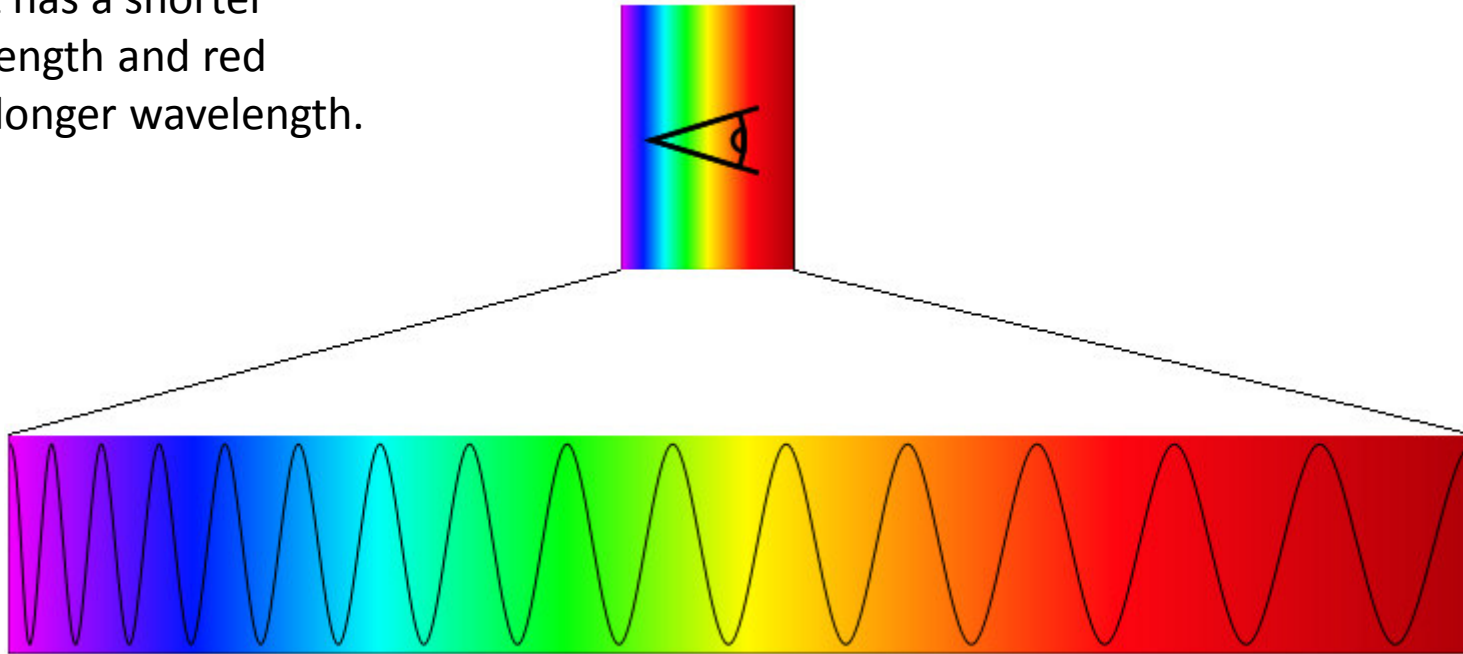


Nature of Light

- We only see a narrow band of electromagnetic radiation which is called visible light or white light.
- When visible light passes through a prism, it is bent or refracted into the color spectrum.



- When visible light is refracted, it is separated into its component colors in the order of their wavelengths, producing the rainbow of colors.
- Violet has a shorter wavelength and red has a longer wavelength.

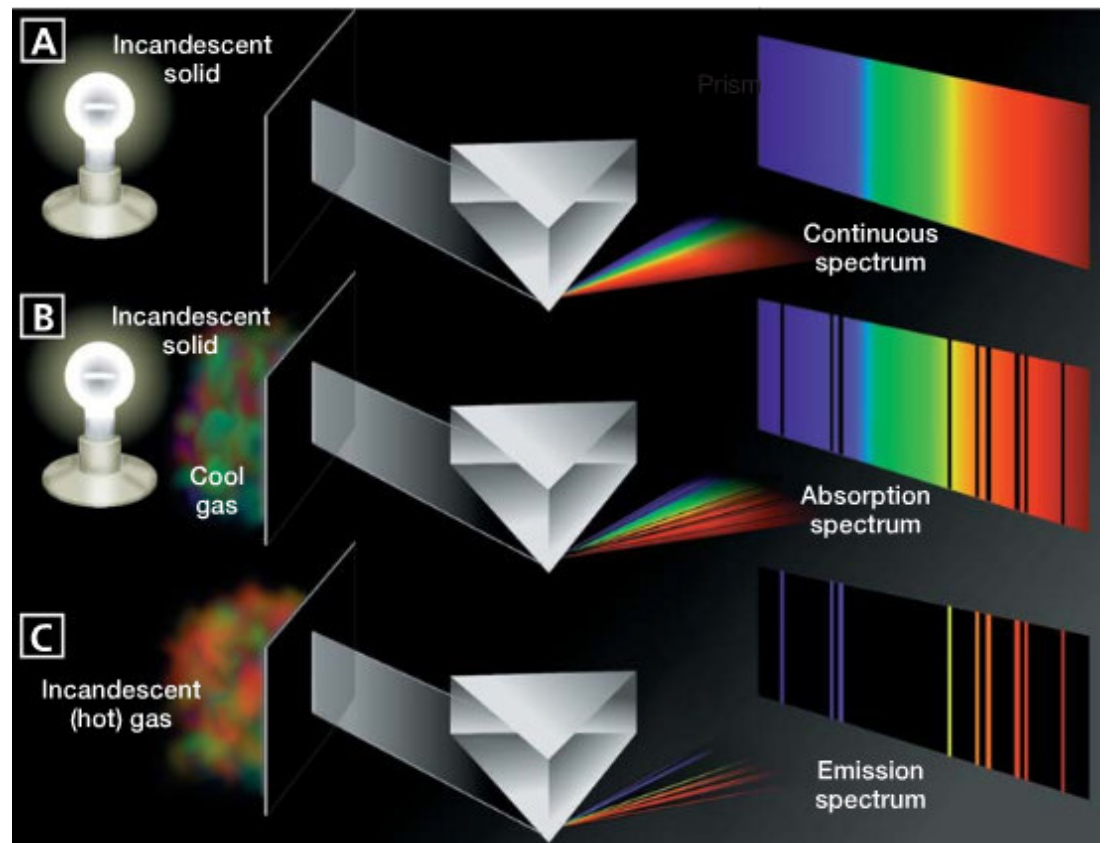


Photons

- Under the photon theory of light, a *photon* is a discrete bundle of electromagnetic energy, (light). Photons are always in motion and, in a vacuum, have a constant speed of light to all observers, at the vacuum speed of light.
- A photon is the smallest discrete particle of energy that travels along a wave defined by its wavelength.
- Each photon has a specific amount of energy. Violet is slower and is bent the most because it travels slower through water or glass than the other colors: red is the fastest.

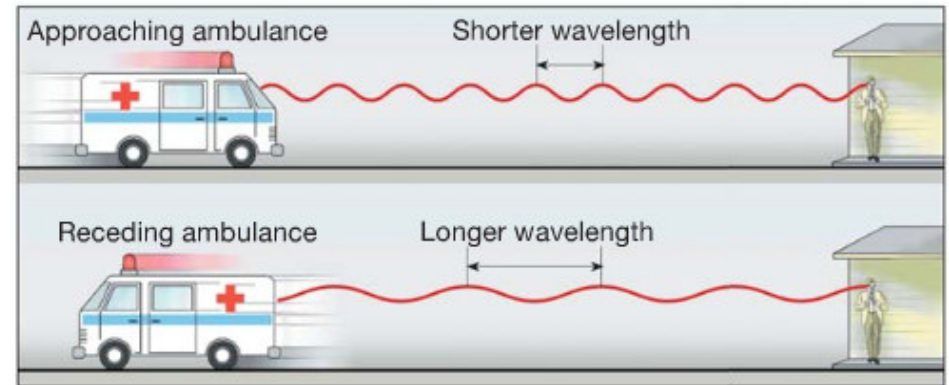
Spectroscopy

- Without knowing it, Sir Isaac Newton introduced the field of spectroscopy when he used a prism to disperse visible light into component colors.
- **Spectroscopy** is the study of the properties of light that depend on wavelengths.
- Newton experiments produced all wavelengths of visible light.
- A **continuous spectrum** is produced by an incandescent solid or gas under pressure – light from a common light bulb.
- **Absorption spectrum** is produced when visible light is passed through a relatively cool gas under pressure.
- **Emission spectrum** is produced by a hot gas under low pressure.
- When the spectrum of a star is studied, the spectral lines act as “fingerprints” which identify the elements of the star’s chemical composition.



The Doppler Effect

- The sudden change in pitch of an ambulance as it passes by was first explained in 1842 by Christian Doppler. His **Doppler Effect** is the shift in frequency and wavelength of a wave that is emitted from a source that is moving away or toward an object.
- The visual light from a source that is moving away from an observer appears redder because its waves are lengthened.
- Objects moving toward an object have their light waves shifted toward the blue, or shorter wavelength.
- In astronomy, the Doppler effect is used to determine whether a star or other body in space is moving away from or toward Earth.



The Doppler Effect for a Moving Sound Source

