Astro 301/ Fall 2006

(50405)

Introduction to Astronomy

http://www.as.utexas.edu/~sj/a301-fa06

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TAs: Biqing For, Candace Gray, Irina Marinova

Lecture 13 Tu Oct 17

Announcements

- Exam 1 : Well done! A=40% B=30% C=18% D=7% F=5%

- Homework 2 given back today. Solution set posted outside lecture hall
  Q1 : Candace Q2: Irina Q3: Bi-Qing

- Quiz 3 next Tuesday: Everything since quiz 2.

Recent and upcoming topics in class

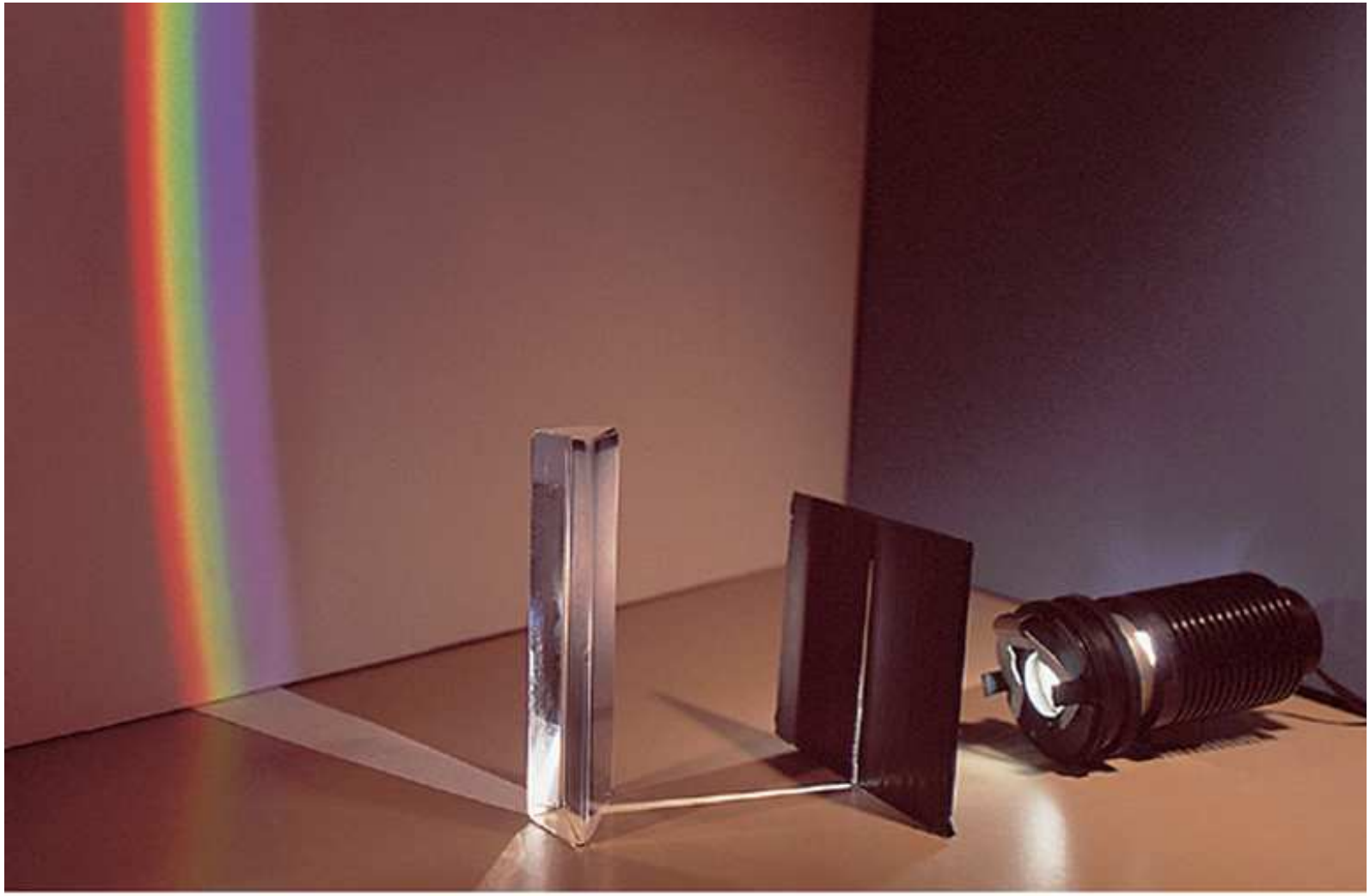
-- Light as electromagnetic waves (continuned)

- Processing light as electromagnetic waves
- Optical light and optical color

-- Unveiling the properties of stars from their light (continuum emission)

- Luminosity versus Flux
- Spectrum of an object: continuum emission, absorption lines, emission lines
- Kirchhoff's first law
- Wien's law: relating surface temperature and wavelength of maximum emission
- The temperatures of stars
- Stefan Boltzmann's law : relating surface temperature and surface flux of a star
- The luminosity function of stars
- The Hertzsprung-Russell diagram.
- Types of stars
- The norms and extremes of stellar radii and densities.

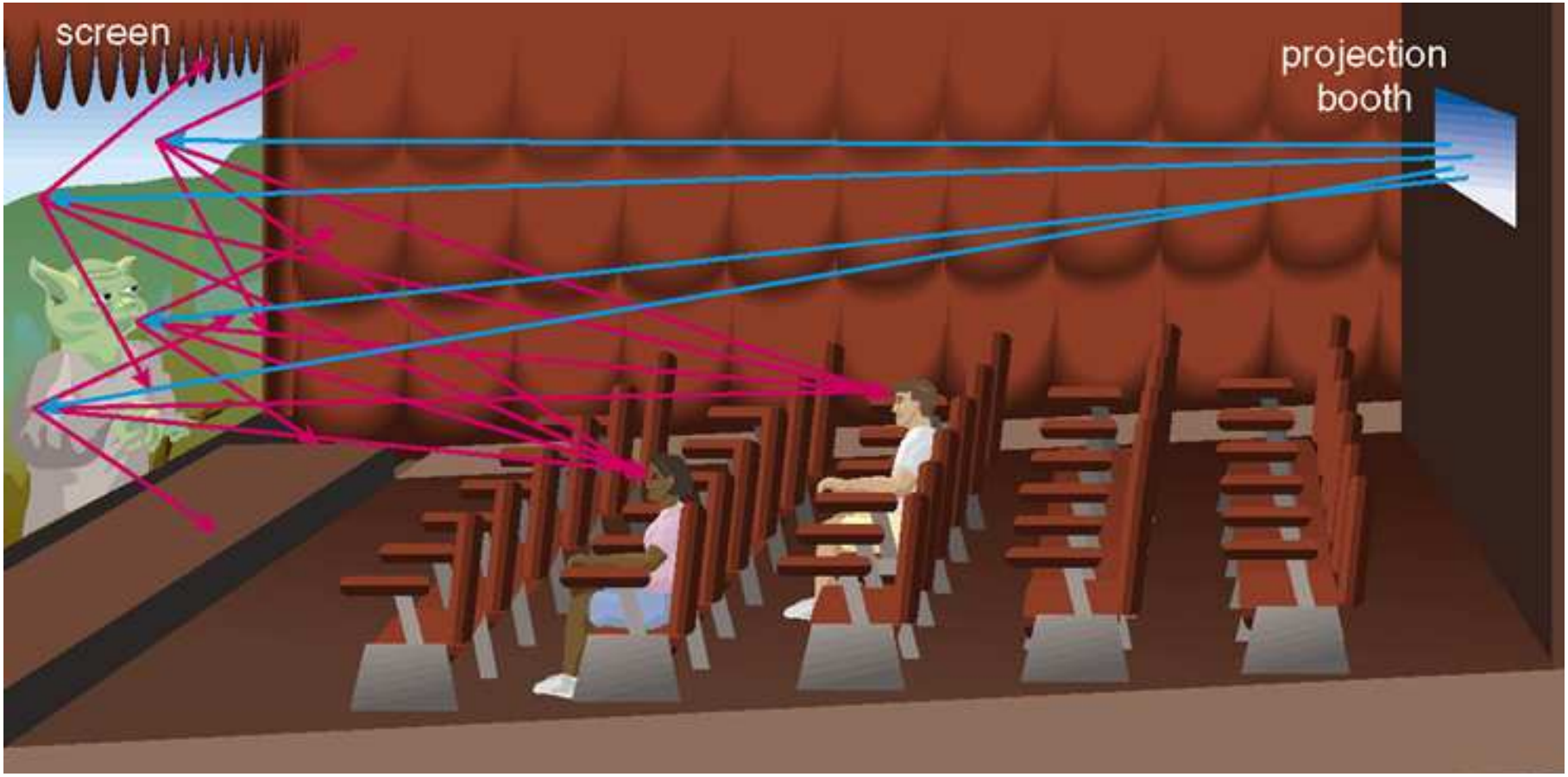
Processing light as electromagnetic waves



Dispersing while light into its constituent optical EM waves

Violet, Blue, Green, Yellow, Orange Red

Processing light as electromagnetic waves

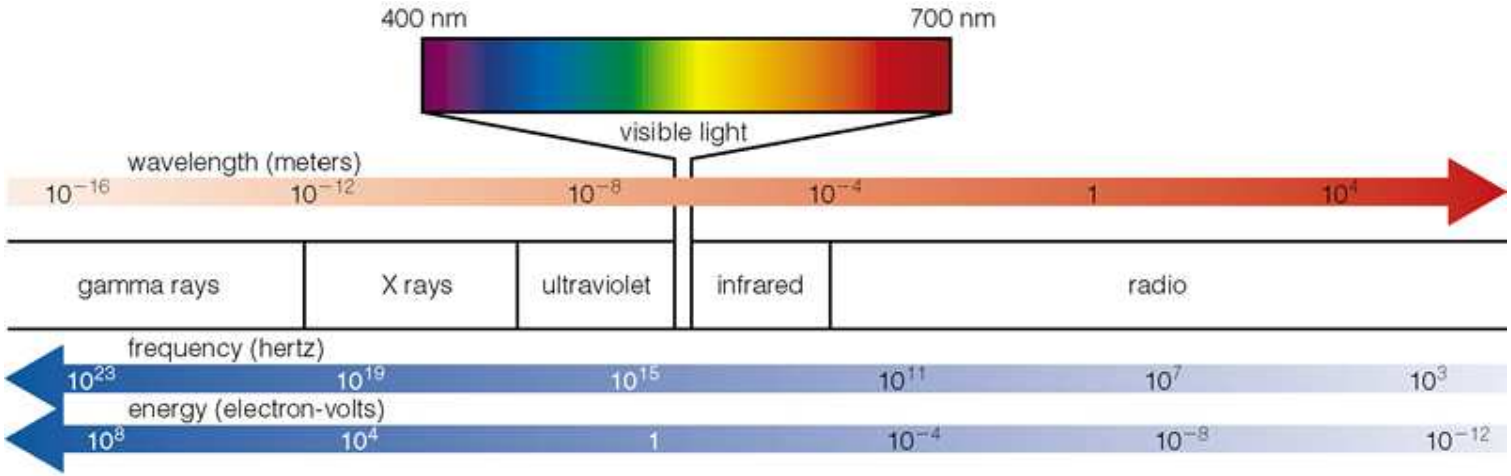


Emission, Transmission, Absorption, Reflection

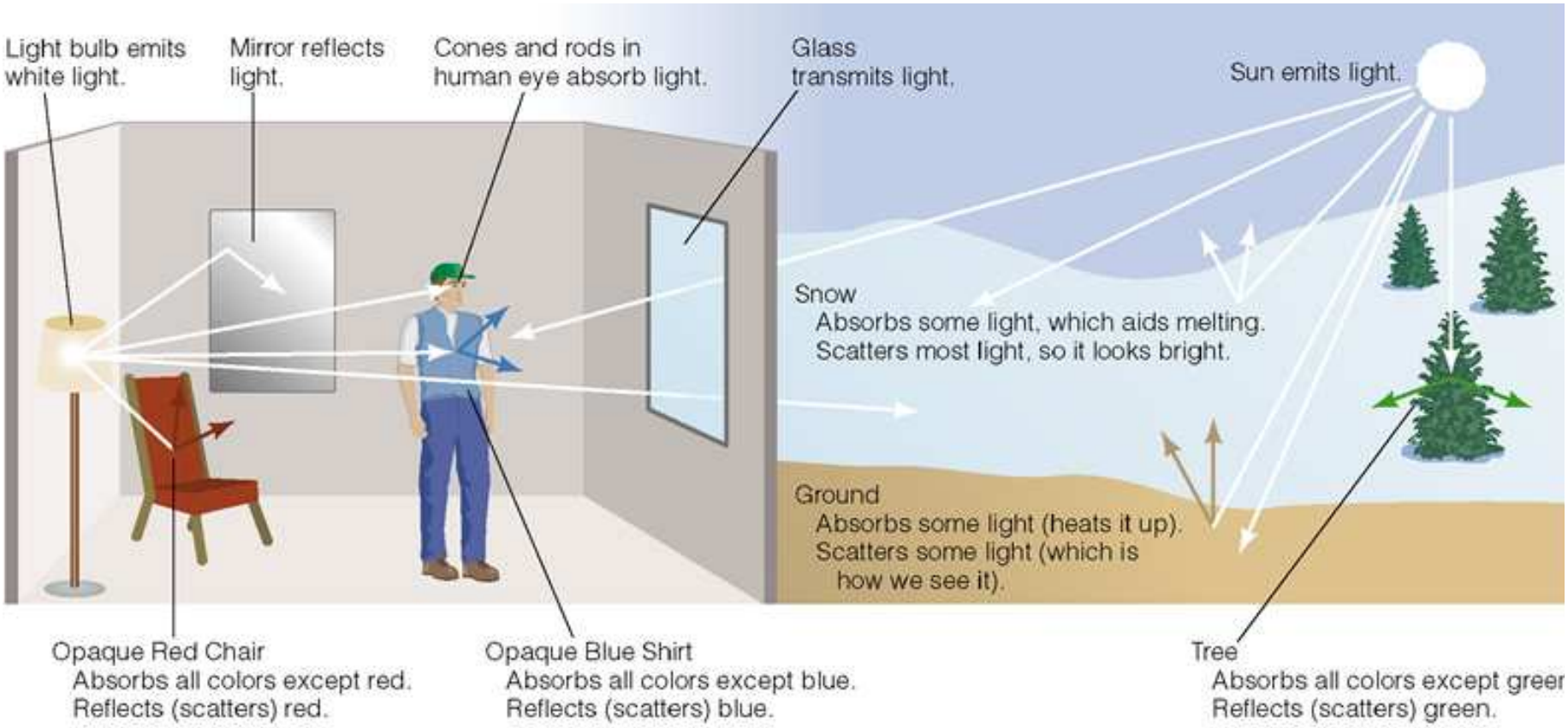
Optical light and optical color

A body emits light across a large range of the EM spectrum: infrared, optical, UV, etc
But human eye is sensitive to the optical (visible) part of the EM spectrum

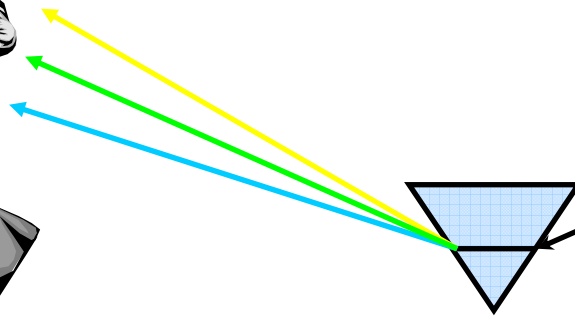
Type of EM wave	Typical wavelength
Gamma rays	10^{-16} m
X rays	10^{-12} m
Ultraviolet	3 x 10^{-7} m
Optical	4 to 9 x 10^{-7} m = Violet, blue, green, yellow, orange, red
Infrared	10^{-6} m to 10^{-4} m
Radio	10^{-3} m to 10 m

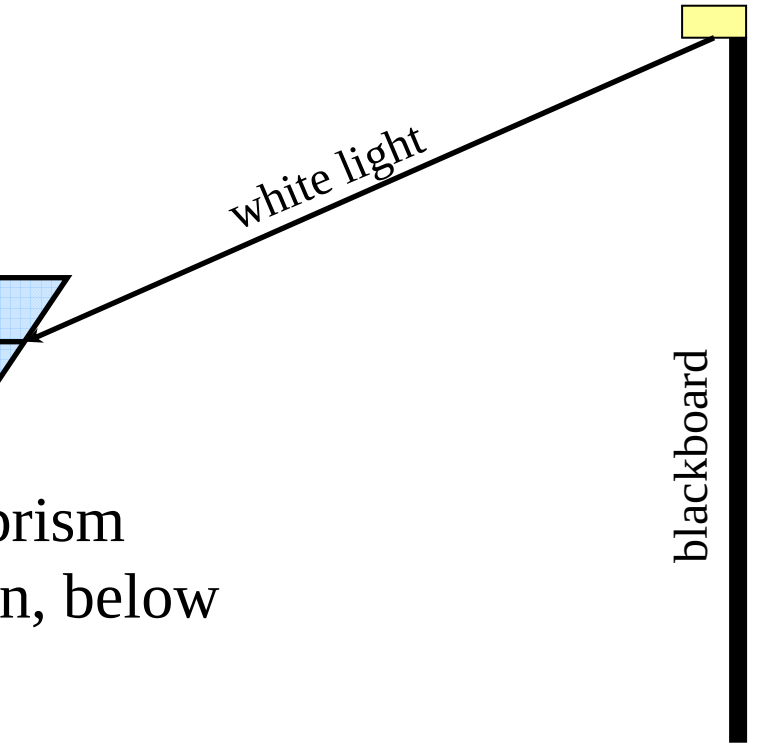


Concept of 'color' of an object



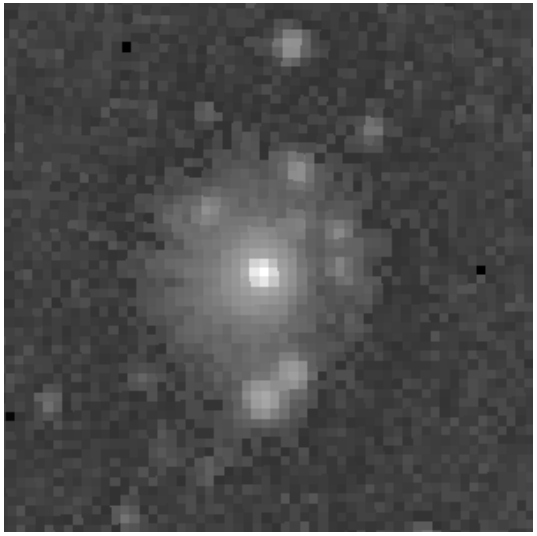
How to Hold the Prism to See a Spectrum



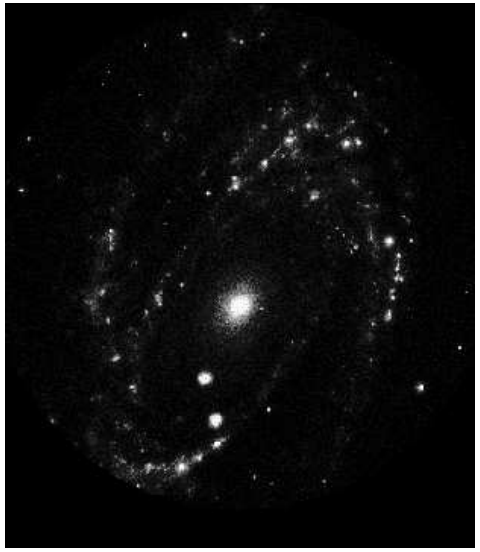


Hold the prism point down, below eye level.

What information does light from distant stars/galaxies carry?



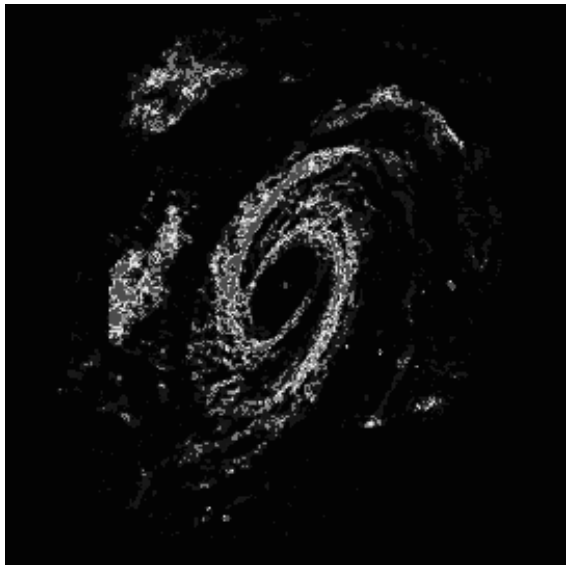
X-ray/ROSAT



Ultraviolet/ASTR0-1

Visible light

Near infrared/Spitzer



Radio 21cm/VLA

Why does the same galaxy (M81) look so different when we look at the light it emits at different wavelengths (from X-ray to visible to radio)?

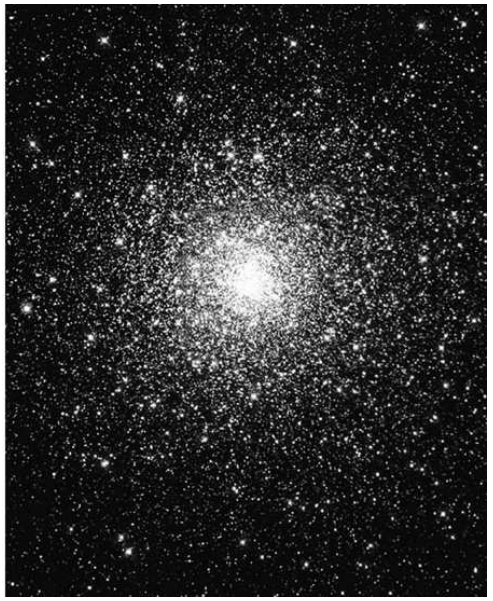
Luminosity versus Flux of an object

1. See in –class notes: difference between flux and luminosity
   flux depends inversely on the square of the distance.

2. Demo : Which object has a higher luminosity?

What information does light from distant stars/galaxies carry?

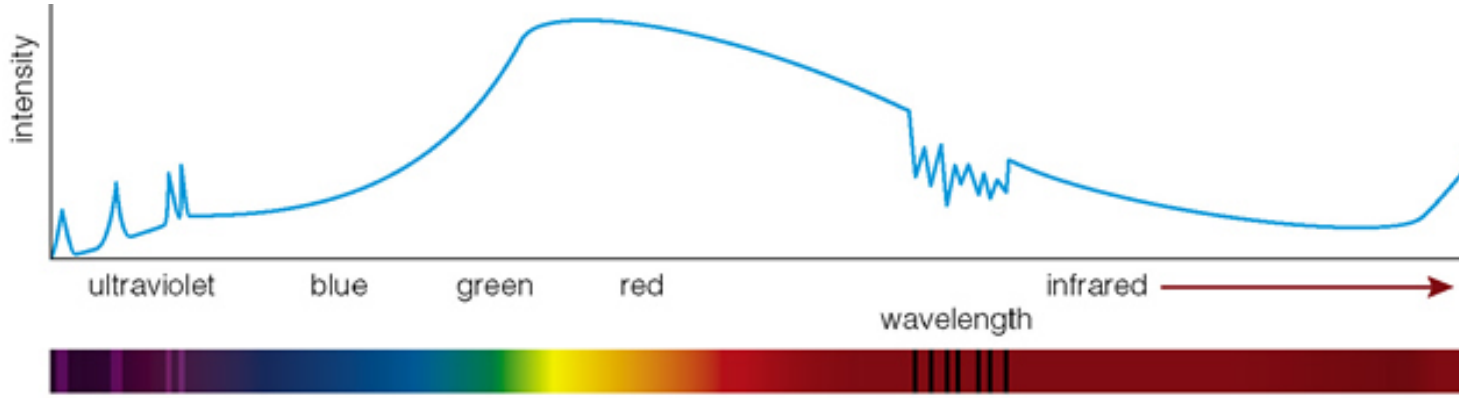
Pleiades stellar cluster



M80 globular cluster (HST image)

What does the light from a star tell us about the properties of the star?
(temperature, radius, luminosity of the star)

A Spectrum



1) A spectrum is a plot of the intensity of light at each wavelength.

When the total flux from an object is separated into the flux at different wavelengths and the intensity of the flux is plotted against wavelength, we get a spectrum for that object.

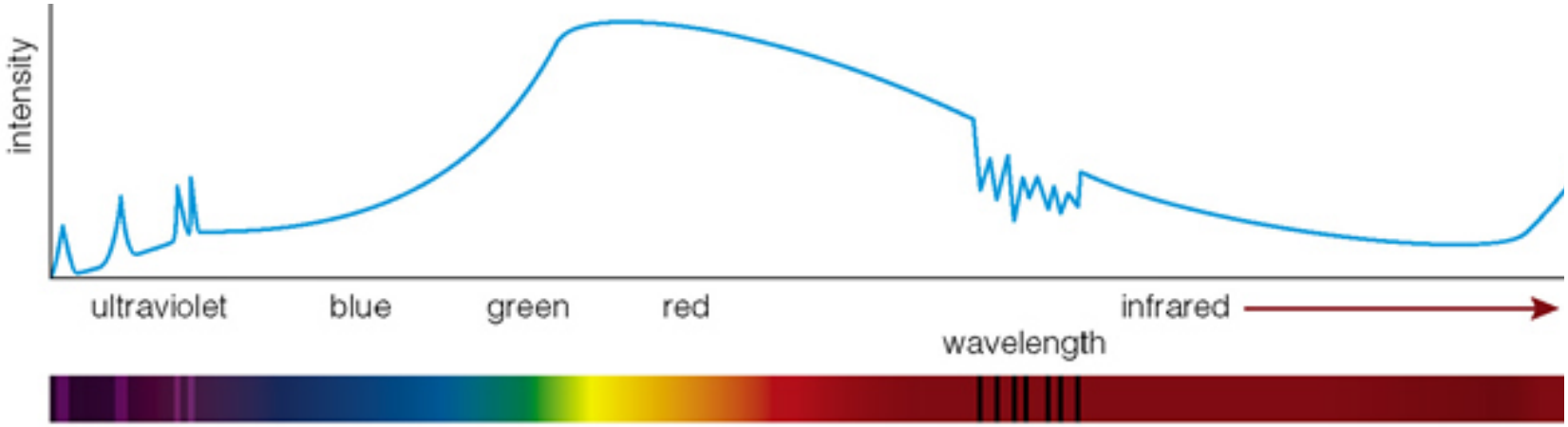
2) In general a spectrum can have 3 types of features:

continuum emission : emission over a continuous range of wavelengths

emission lines : emission above the continuum at specific wavelengths

absorption lines: lack of emission (dip below the continuum) at specific wavelengths

Information in a spectrum



Amazingly, the continuum ermission , emission lines, absorption lines. in the spectrum of an object can reveal to us

- à its temperature
- à the total flux at its surface
- à its chemical composition, (like a DNA genetic code)
- à its recession speed, its distance