

Pre-Lab: Basics of Photometry

Photometry with our eyes



Image taken from <http://en.wikipedia.org/wiki/Hipparchus>

If *you* look up at the sky, *you'll* notice that some stars are brighter than others. The reason is that your eye is a rather sophisticated light detector, or photometer (a device that measures light). Our eyes measure a quantity called flux, the energy per second per unit area [E/sec/area]. Twenty-two hundred years ago, a Greek scholar named Hipparchus (see above picture) catalogued some stars. He called the brightest stars he saw #1 and the dimmest stars #6, (with other stars in between). This system of cataloging a star's brightness lives on today in our current **magnitude** system, although now we include objects that are brighter than #1 (like the Sun and Moon, as well as some stars) and dimmer than #6 (those that can only be seen with the aid of binoculars or a telescope).

	apparent magnitude
Sun	-26.7
Moon (full)	-12.5
Venus	-4.6
Jupiter	-2.5
Vega	0.0
naked eye limit	+6.0
binocular limit	+11.3
large telescope limit	+20.0
Hubble Space Telescope limit	+30.0

Photometry with Cameras (not CCD's)

Light can be both a wave and a particle. When we talk about photometry it is easier to think of light being a particle, a photon. Imagine that there is a star that fires photons (like bullets) which, when they hit photographic film, leave an imprint. A bright star sends out lots of photons and produces a large imprint while a fainter one sends out fewer photons and produces a smaller imprint. In other words, the size of the imprint is proportional to the total number of photons hitting the photographic film. In this exercise, you will measure these imprints on pictures by measuring the diameters of the white spots. You'll be surprised at how much information you can obtain by analyzing two black and white photos!

Answer the Following Questions

1. Magnitudes, Flux (or Intensity) and Luminosity

a) Define the following quantities and state their units:

Luminosity

Flux

Apparent Magnitude

Distance Modulus

b) First say in WORDS how the following quantities are correlated. Then state a formula.

Luminosity and Flux

Absolute Magnitude and Luminosity

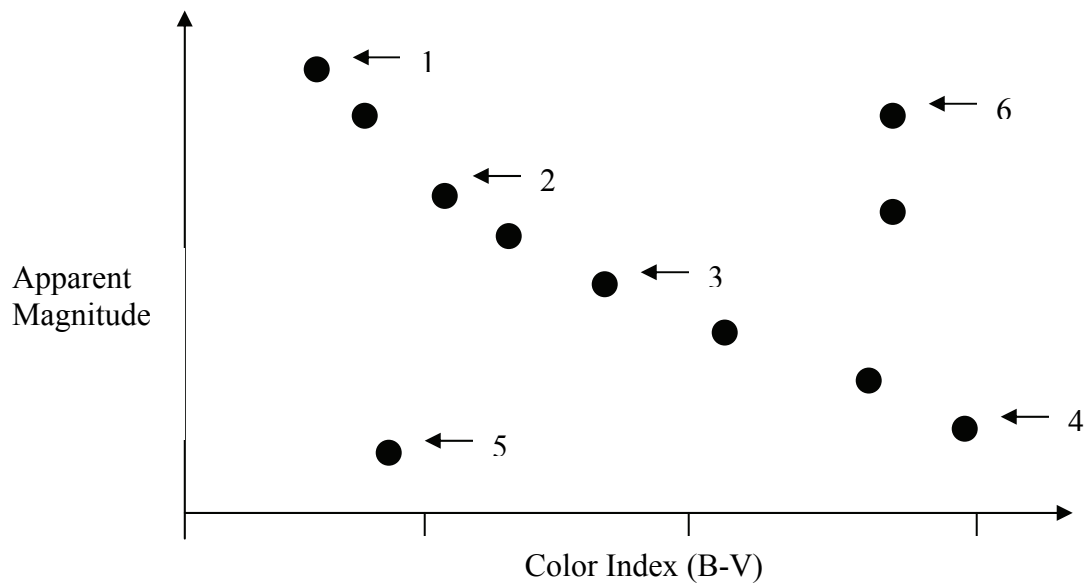
Apparent Magnitude and Flux

Apparent and Absolute Magnitude

c) For which of the above quantities do you need to know distance?

2. Stellar Properties

a) The Hertzsprung-Russell diagram



1. Which star(s) is the hottest? _____
2. Which star(s) is the brightest? _____
3. Which star(s) is the largest? _____
4. Which star(s) is the faintest? _____
5. Which star(s) would appear red? _____
6. Which star(s) is a main sequence star? _____
7. Which star(s) is a white dwarf? _____

b) If two stars in the sky have the same brightness; they must also have the same:

	Yes/No	Why?
Absolute Magnitude	_____	_____
Apparent Magnitude	_____	_____
Luminosity	_____	_____
Color	_____	_____
Temperature	_____	_____
Spectral Type	_____	_____
Distance	_____	_____