Review for Test #1 on September 13

Topics:

- Foundations of Astronomy - measurement, exponential notation, etc.
- The Copernican Revolution - Newton's Laws, Gravitation, etc.
- Radiation and the Electromagnetic Spectrum - Black bodies
- Atoms and Spectroscopy - Doppler Effect, Bohr model
- Telescopes

Methods

- Conceptual Review and Practice Problems Chapters 1 - 4
- Review lectures (on-line) and know answers to clicker questions
- Try practice quizzes on-line (in Smartworks)

•Bring:

- Two Number 2 pencils and your Lobo ID
- Simple calculator (no electronic notes)

Reminder: There are NO make-up tests for this class

Test #1 Review

How to take a multiple choice test

1) Before the Test:

- Study hard
- Get plenty of rest the night before

2) During the Test:

- Draw simple sketches to help visualize problems
- Solve numerical problems in the margin
- Come up with your answer first, then look for it in the choices
- If you can't find the answer, try process of elimination
- If you don't know the answer, Go on to the next problem and come back to this one later
- TAKE YOUR TIME, don't hurry
- If you don't understand something, ask me.

Test #1 Useful Equations

Kepler's laws, including: $P^2 \ \alpha \ a^3$

Newton's laws, including: $F = ma$

Gravitation:

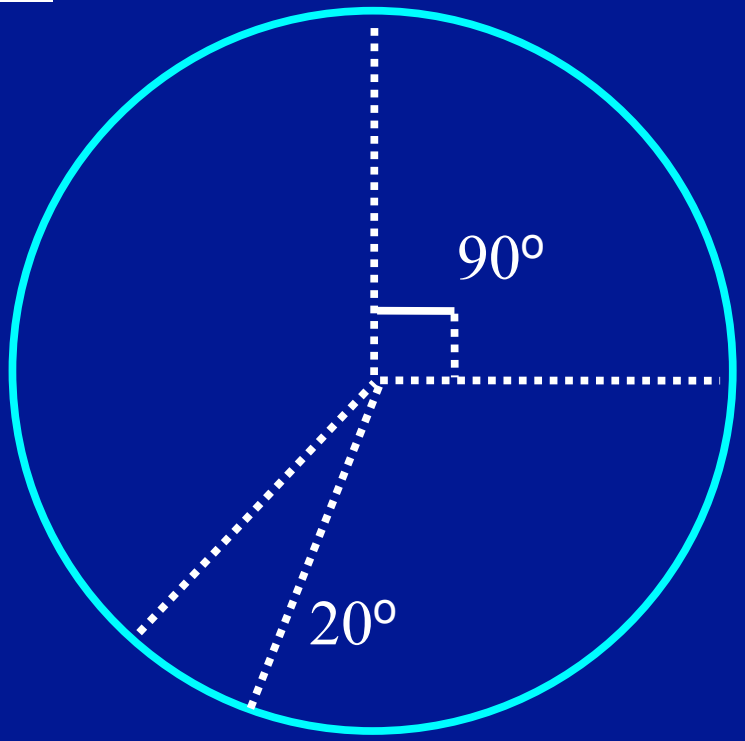
$$F = \frac{G\, m_1\, m_2}{R^2}$$

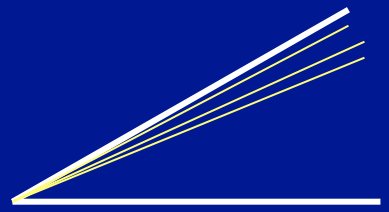
Speed of electromagnetic waves: $c = \lambda \nu$ Energy = $h\nu$

Wien's Law: $\lambda_{\text{max energy}} \ \alpha \ \frac{1}{T}$

Stefan's Law: $L = A\, T^4$ where the area $A = 4\pi r^2$ for a sphere

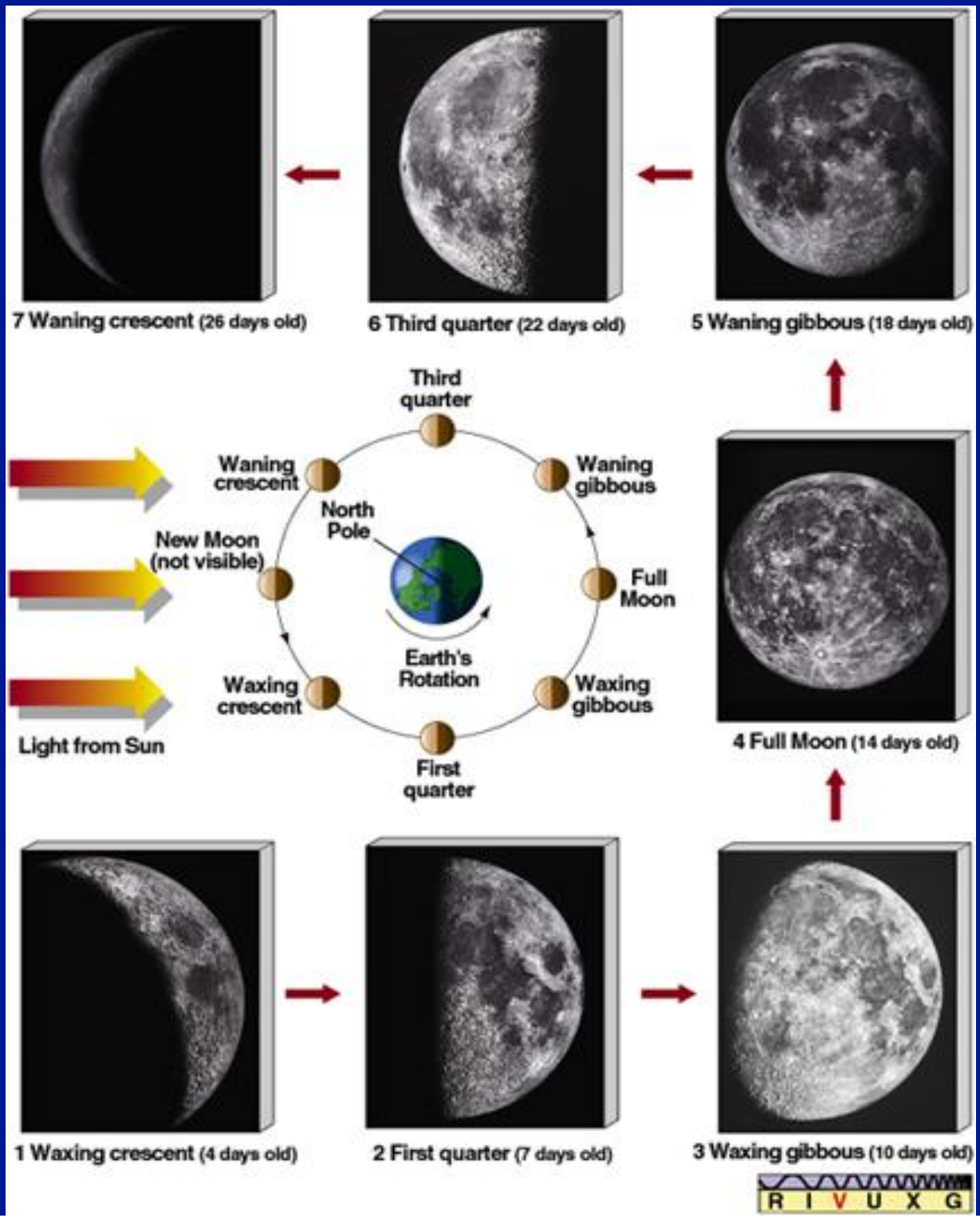
Angular Measure



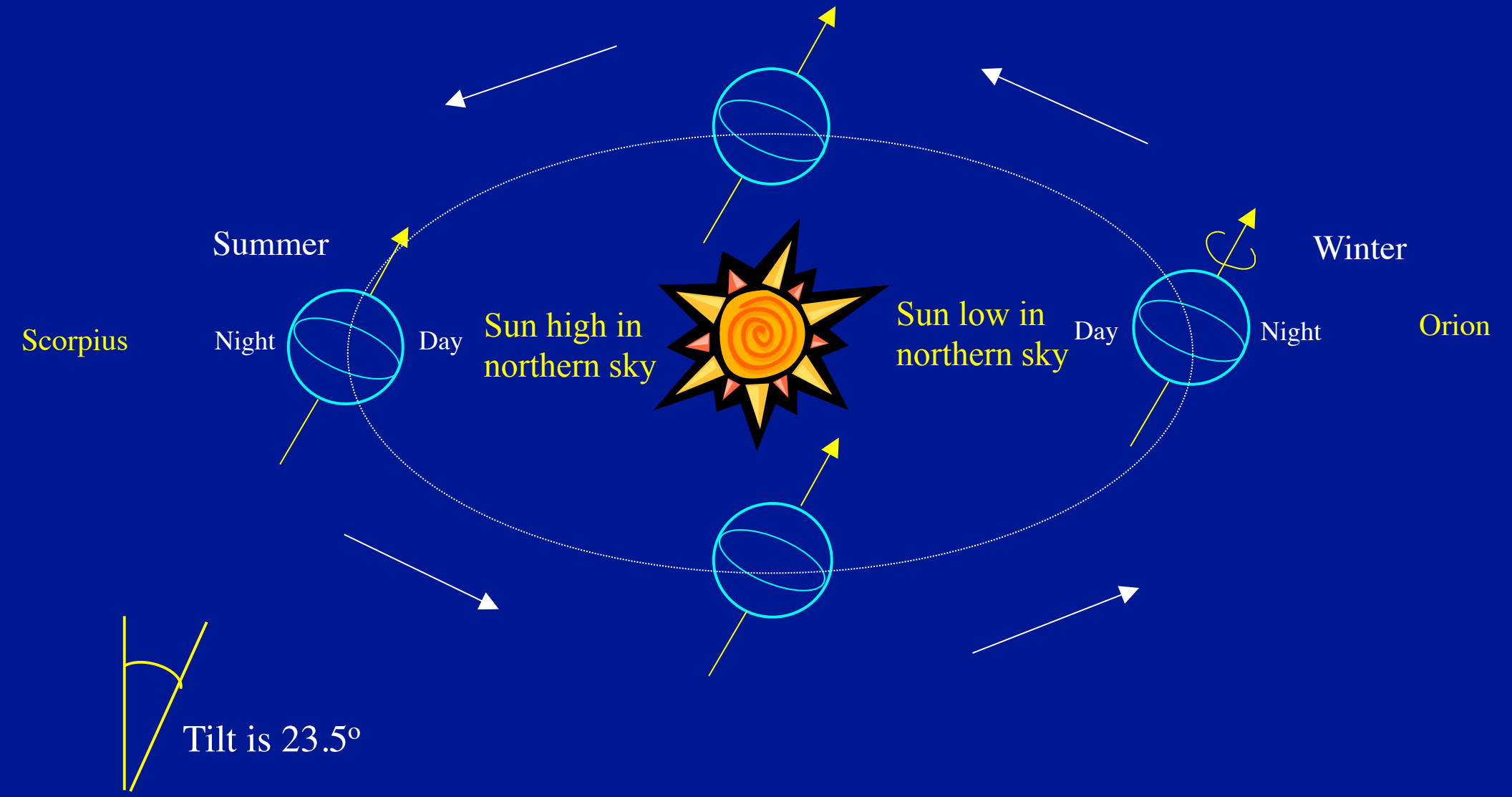


360°, or 360 degrees, in a circle.

1° = 60' or arcminutes
1' = 60" or arcseconds
1" = 1000 mas or milli-arcseconds = 10^3 mas


7 Waning crescent (26 days old)
6 Third quarter (22 days old)
5 Waning gibbous (18 days old)
Third quarter
Waning crescent
Waning gibbous
North Pole
New Moon (not visible)
Full Moon
Earth's Rotation
Waxing crescent
Waxing gibbous
First quarter
Light from Sun
4 Full Moon (14 days old)
1 Waxing crescent (4 days old)
2 First quarter (7 days old)
3 Waxing gibbous (10 days old)
R I V U X G

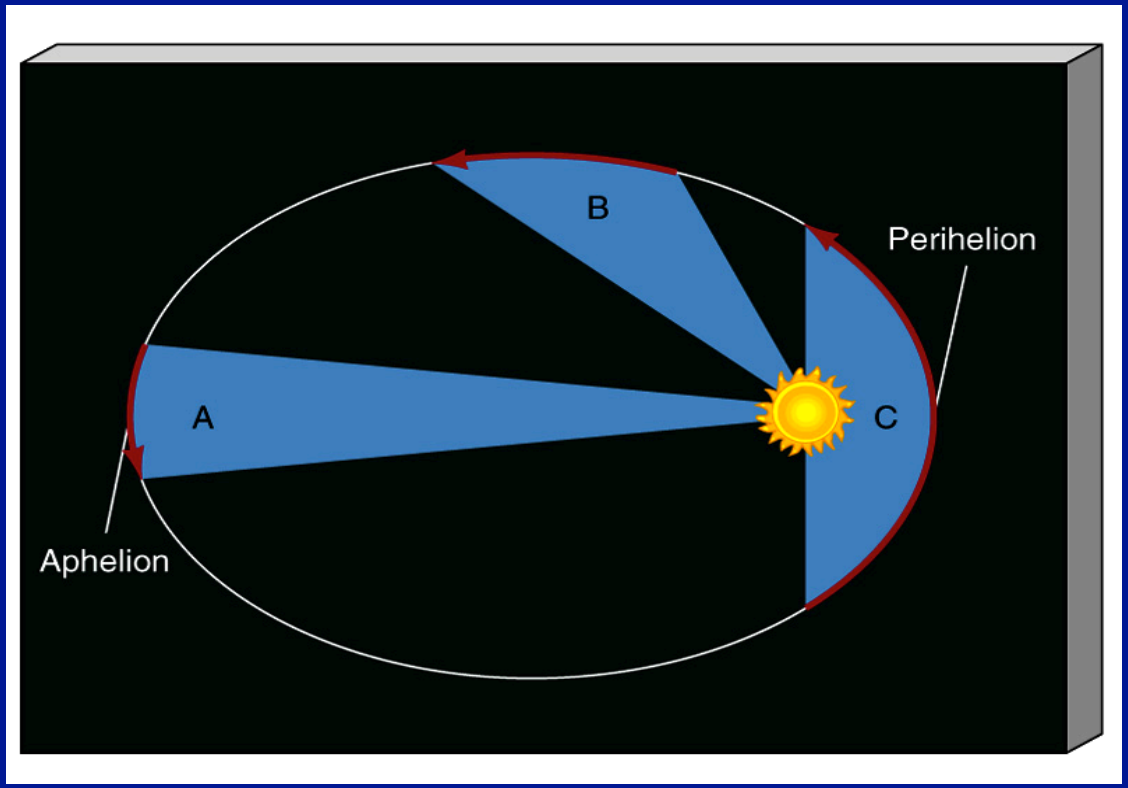
The Earth's rotation axis is tilted with respect to its orbit around the Sun => seasons.



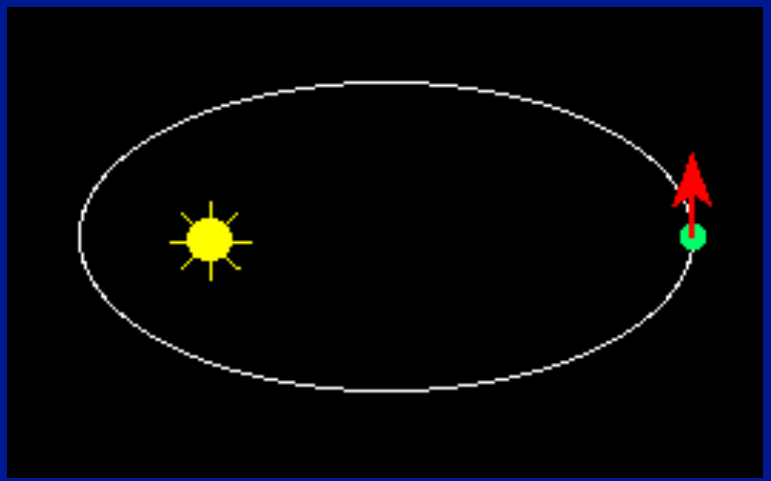
Kepler's Second Law

A line connecting the Sun and a planet sweeps out equal areas in equal times.

slower



faster



Translation: planets move faster when closer to the Sun.

Newton's Second Law of Motion

When a force, F, acts on an object with a mass, m, it produces an acceleration, a, equal to the force divided by the mass.

$$a = \frac{F}{m}$$

or $F = ma$

acceleration is a change in velocity or a change in direction of velocity.

Timelines of the Big Names

Copernicus

1473-1543

Galileo

1564-1642

Brahe

1546-1601

Kepler

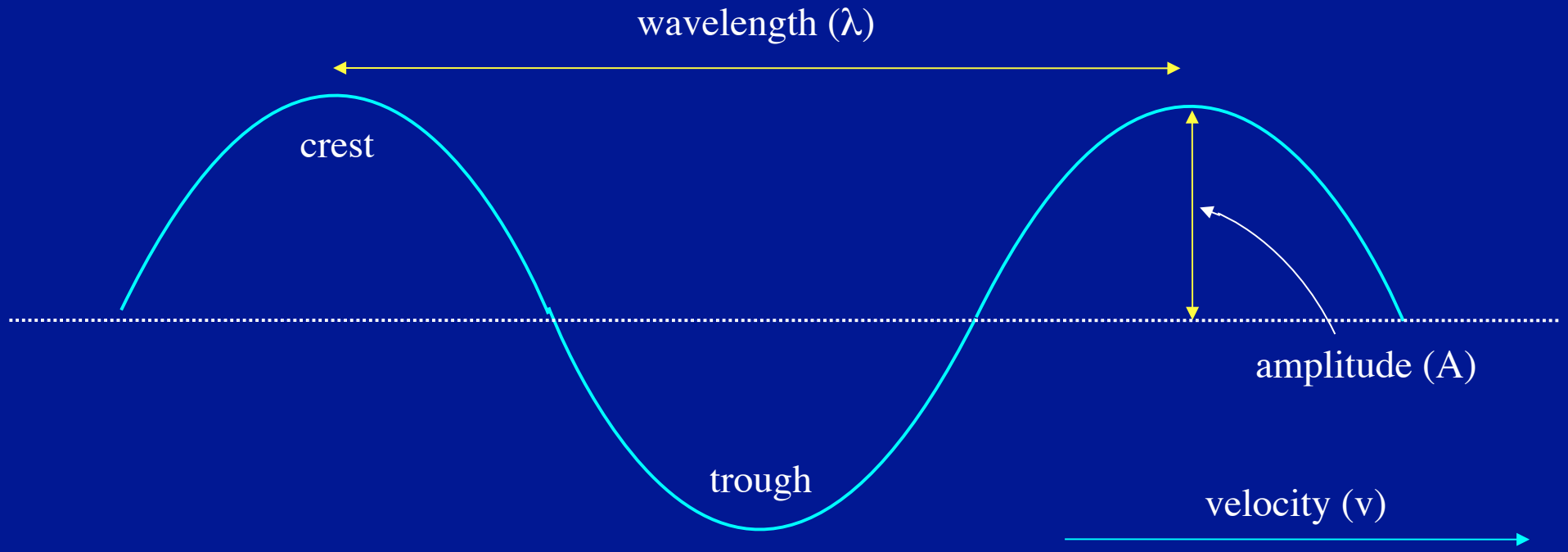
1571-1630

Newton

1642-1727

Review: Properties of a wave

Radiation travels as waves.
Waves carry information and energy.



λ is a distance, so its units are m, cm, or mm, etc.

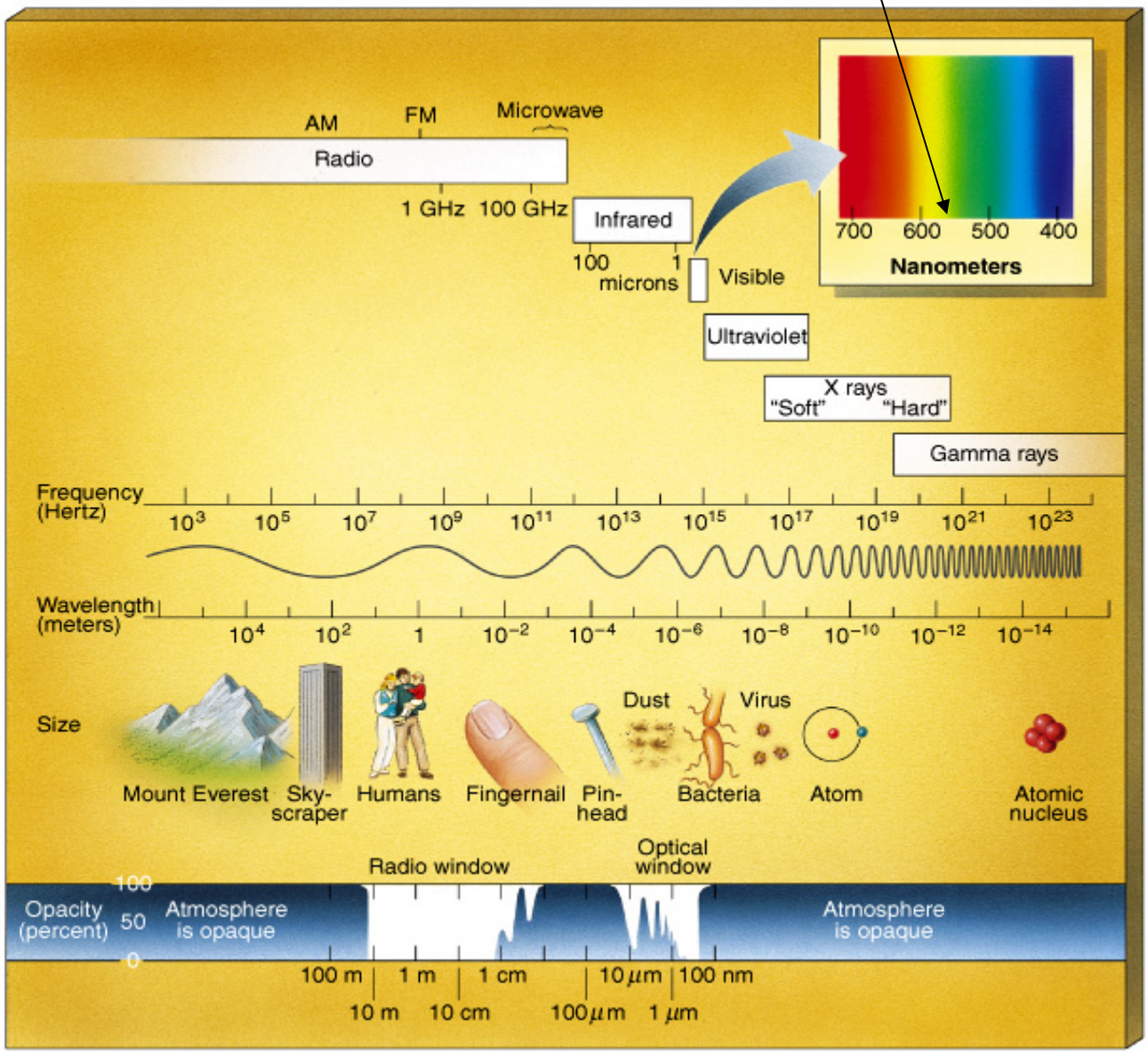
Period (T): time between crest (or trough) passages

Also, $v = \lambda \nu$

Frequency (ν): rate of passage of crests (or troughs), $\nu = \frac{1}{T}$
(units: Hertz or cycles/sec)

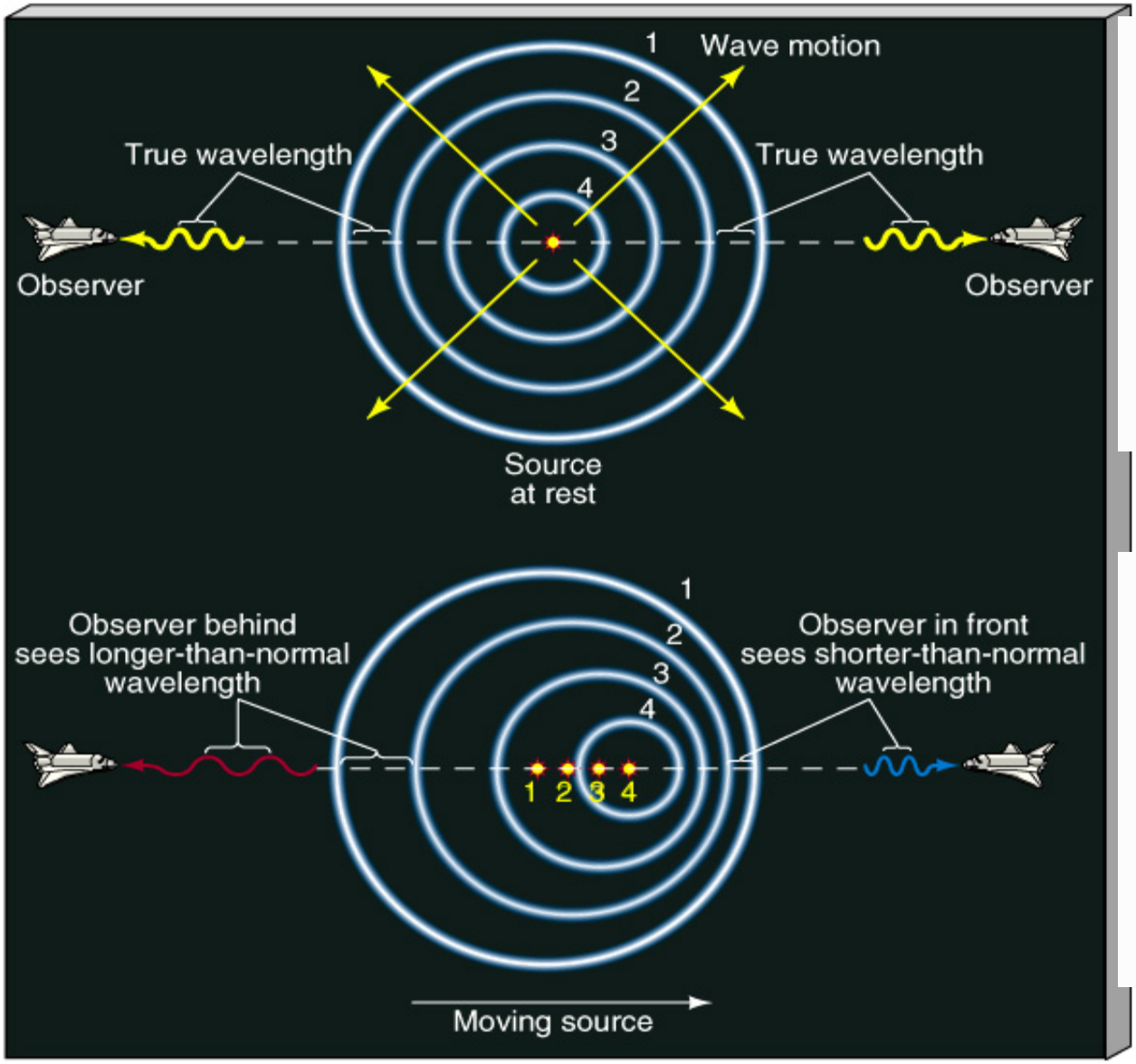
The Electromagnetic Spectrum

1 nm = 10^{-9} m , 1 Angstrom = 10^{-10} m



$c = \lambda \nu$

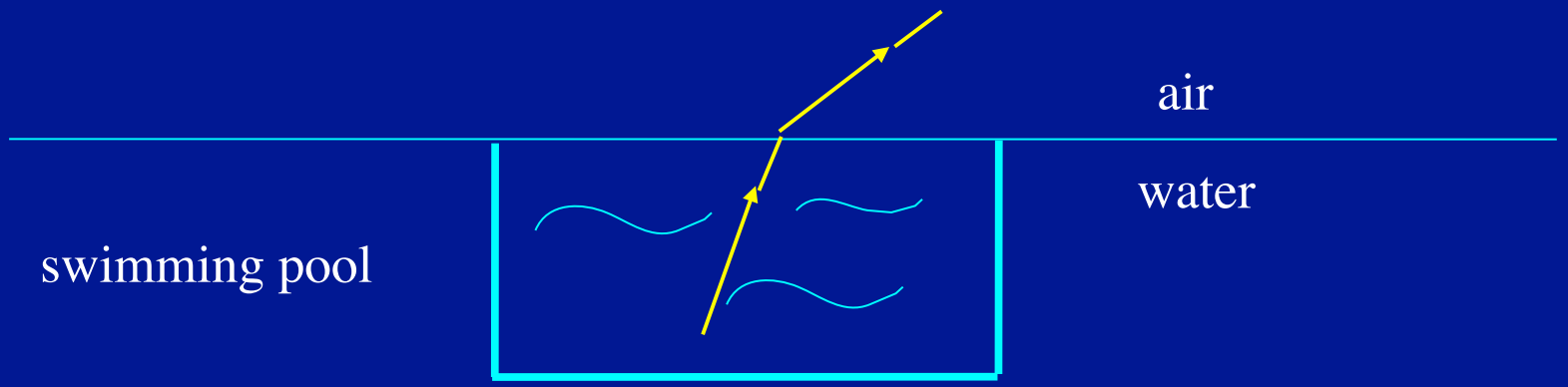
The frequency or wavelength of a wave depends on the relative motion of the source and the observer.



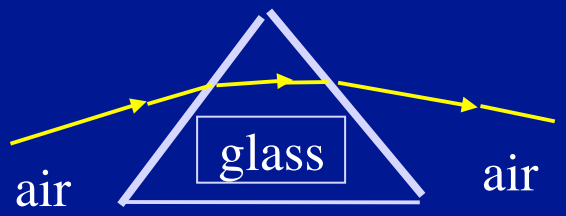
Things that waves do

1. Refraction

Waves bend when they pass through material of different densities.



prism

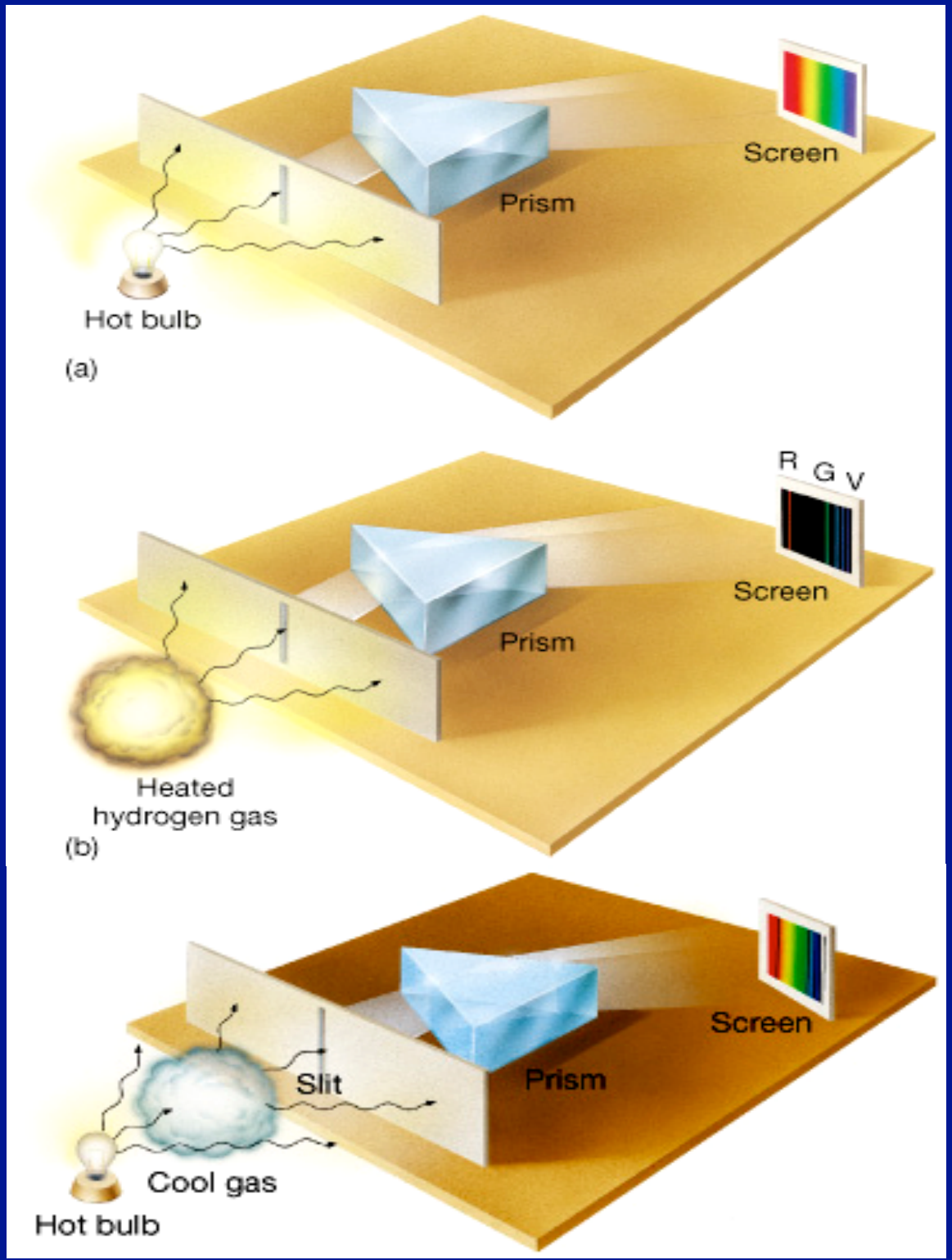


Kirchhoff's Laws

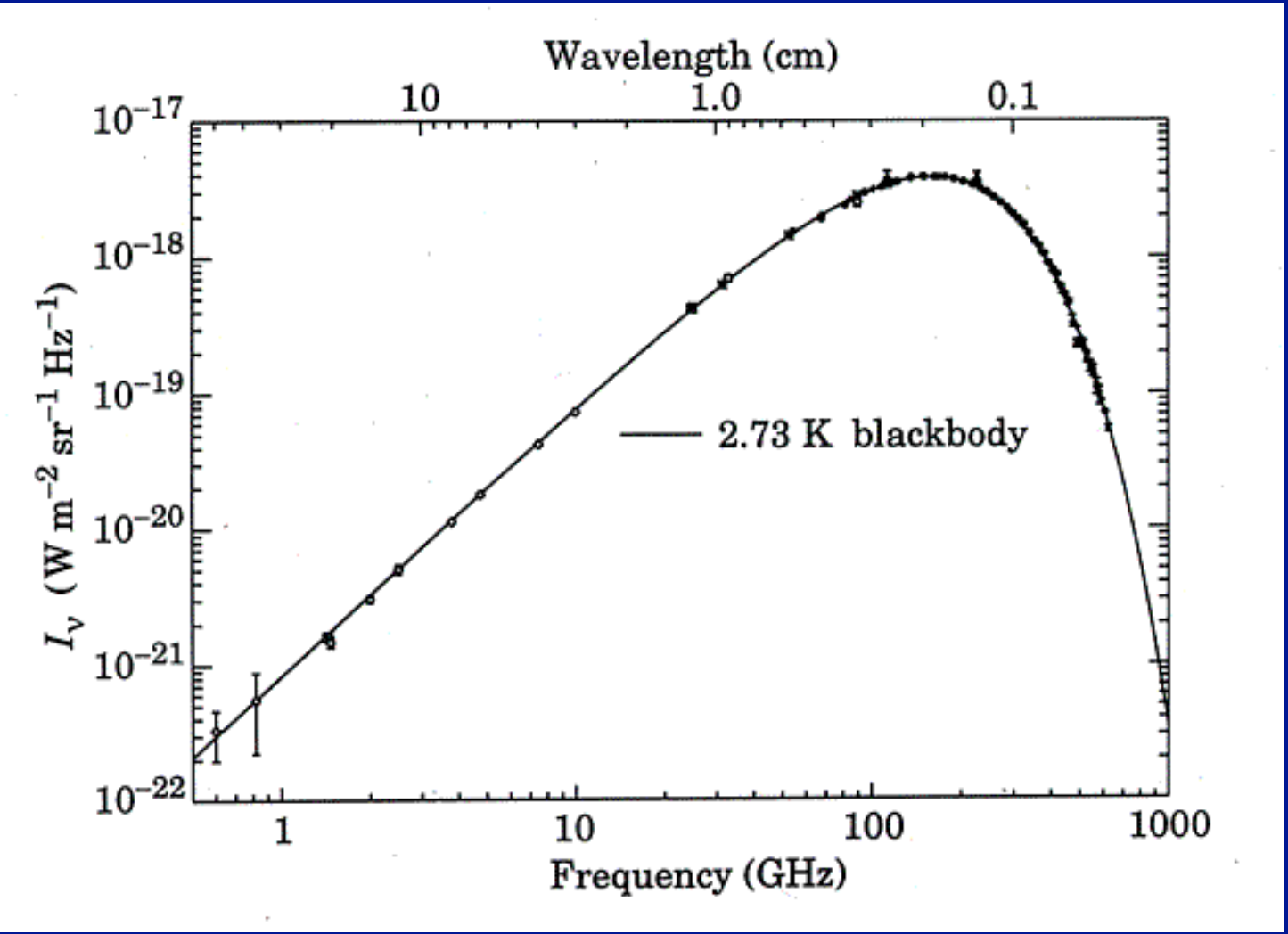
1. A hot, opaque solid, liquid or dense gas produces a continuous spectrum.

2. A transparent hot gas produces an emission line spectrum.

3. A transparent, cool gas absorbs wavelengths from a continuous spectrum, producing an absorption line spectrum.

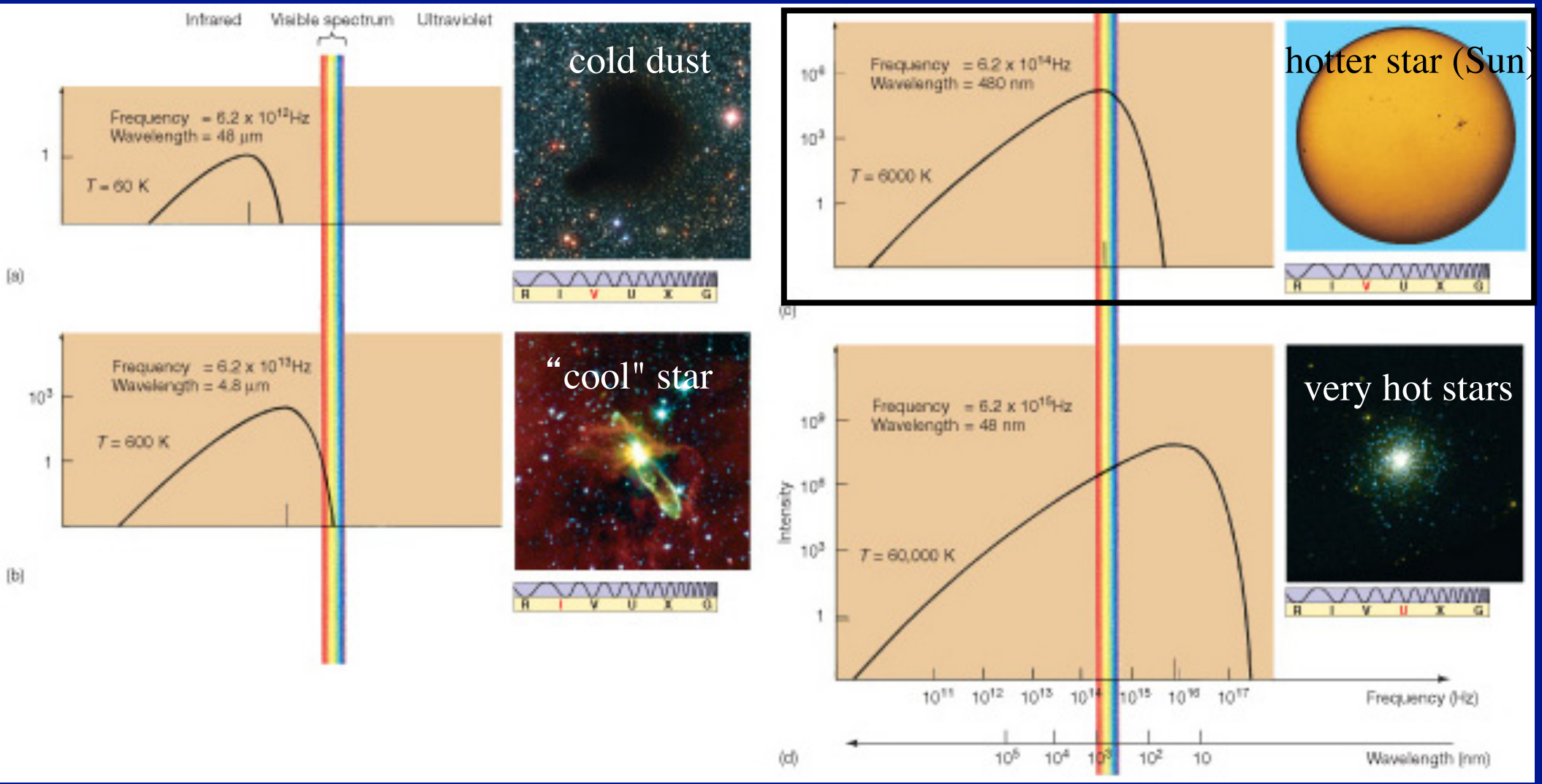


Example: Blackbody - the microwave background



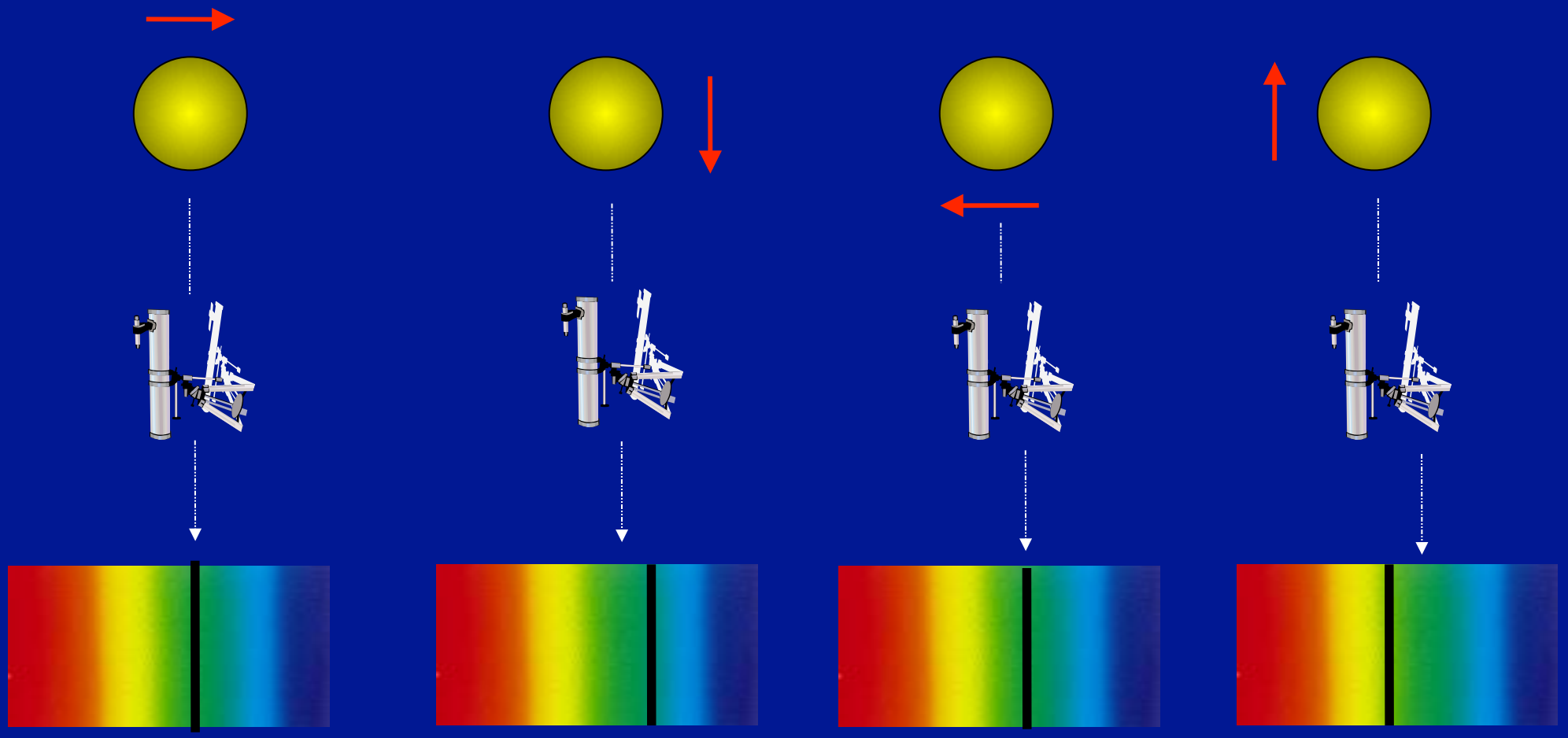
Emits mostly in the radio, with a peak around 200 GHz

Approximate black-body spectra of astronomical objects demonstrate Wien's Law and Stefan's Law



frequency increases,
wavelength decreases →

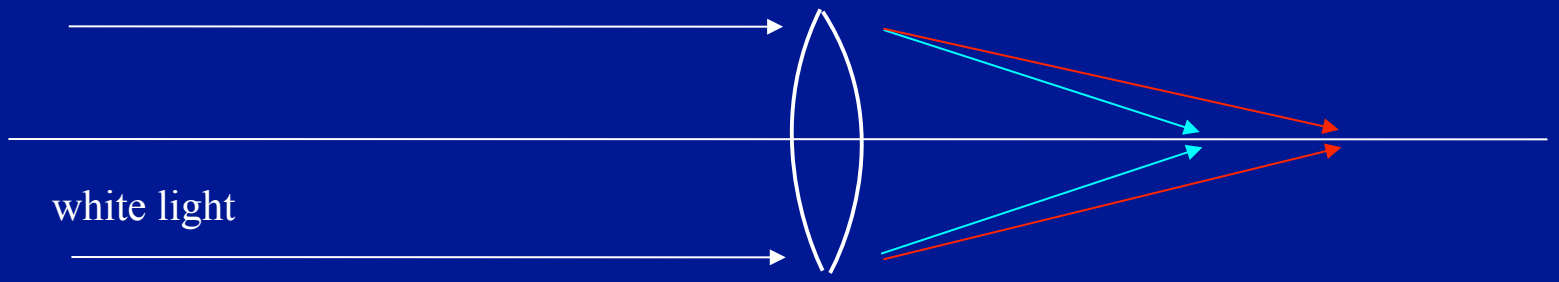
Star wobbling due to gravity of planet causes small Doppler shift of its absorption lines.



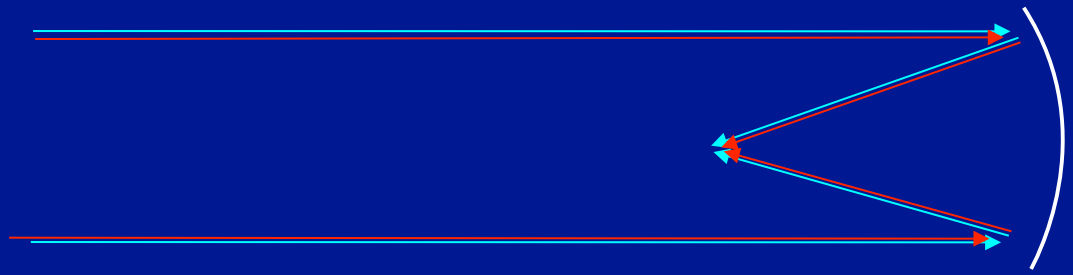
Amount of shift depends on velocity of wobble. Also know period of wobble. This is enough to constrain the mass and orbit of the planet.

Chromatic Aberration

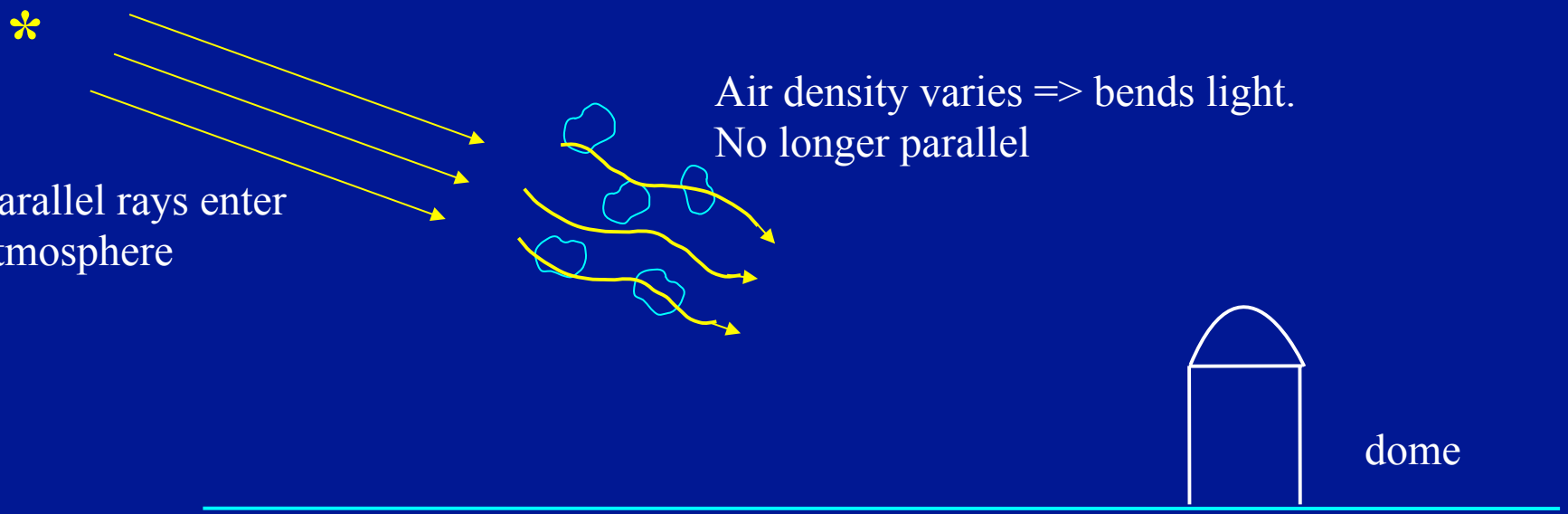
Lens - different colors focus at different places.



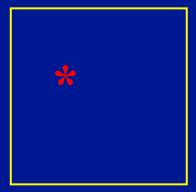
Mirror - reflection angle doesn't depend on color.



Seeing

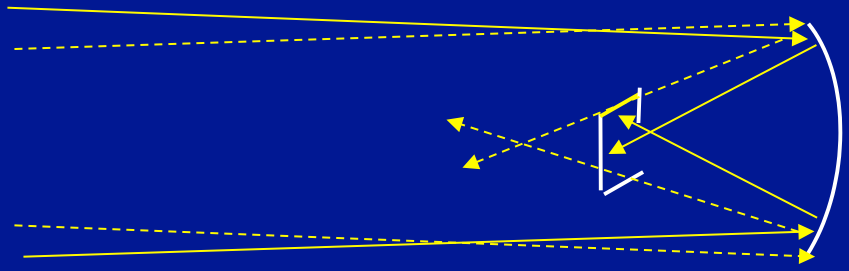


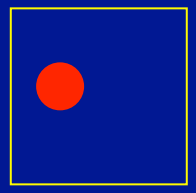
No blurring case. Rays brought to same focus.



Sharp image on CCD.

Blurring. Rays not parallel. Can't be brought into focus.





Blurred image.

Effelsburg 100 m telescope