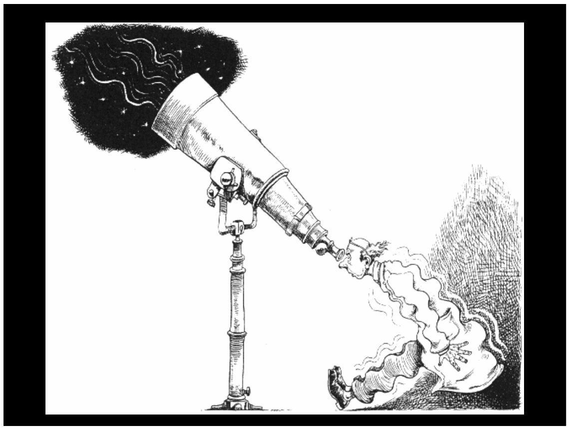


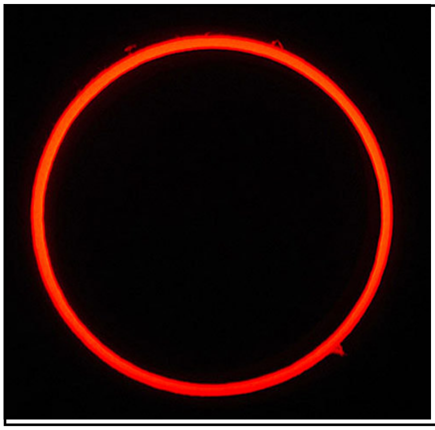
Agenda

- Hand back Sextant Labs, go over, discuss black numbers
- Read Ch. 6 (and quiz) by next week
- Plan observations: M (10/24) and W (10/26) Night 7:30pm…Bring
  - pen/paper
  - Star/constellation/planet chart printout (from Stargazer or elsewhere)
- Project Ideas Due

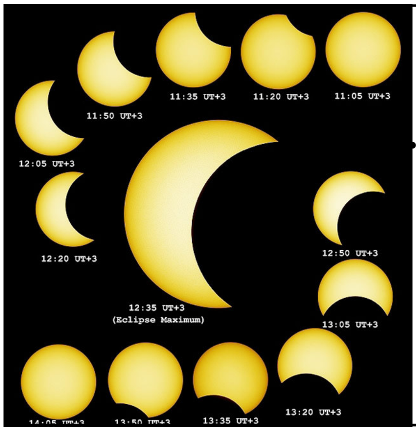
- Review Ch. 5
- Telescope, Refraction, Reflection

Annular Eclipse of the Sun (on 10/3/05)

- Visible only from Europe

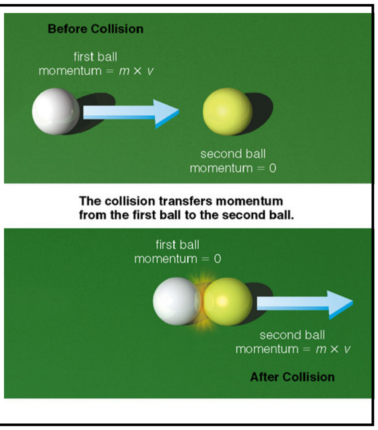


Prominences of ionized hydrogen visible w/ special filter

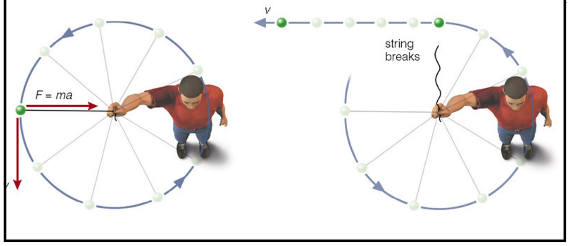


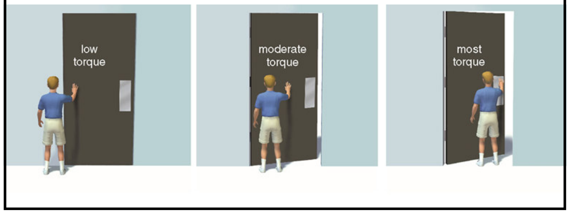
- Only a partial eclipse from Greece

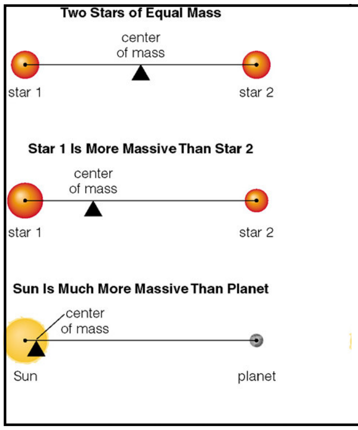
- Telescope aimed at the sun: Solar

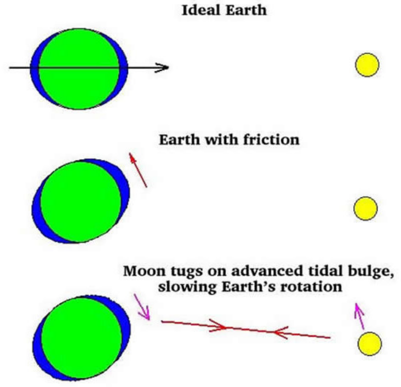


Newton’s First Law

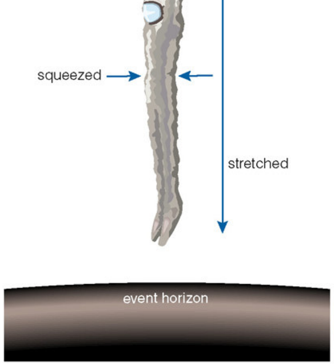








Extreme Tide



Newton's Universal Law of Gravitation

- Force between two masses
- directly proportional to the product of two masses
- Inverse square law
- Gravitational constant ("Big G")

$$F = G\frac{M_1 M_2}{d_{12}^2}$$

$$G = 6.67\times10^{-11} m^3/(kg\times s^2)$$

Objects accelerate at same rate on Earth

- Force between mass m and Earth

$$F = G\frac{M_{Earth}m}{R_{Earth}^2}$$

- Acceleration of object given by

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

- So, for this particular case, acceleration independent of mass m:

$$a = g = G\frac{M_{Earth}}{R_{Earth}^2}$$

What would acceleration be on…

- Say, a planet Liebling with 3 times the mass of Earth but only half the radius?
- 3 times bigger? 6 times? 1/3? 1/6?

What would acceleration be on…

- Say, a planet Liebling with 3 times the mass of Earth but only half the radius?
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- Let's compute:

$$g_{Liebling} = G\frac{M_{Liebling}}{R_{Liebling}^2}$$

- Substitute what we know:

$$g_{Liebling} = G\frac{(3M_{Earth})}{\left(\tfrac{1}{2}R_{Earth}\right)^2} = G\frac{3M_{Earth}}{\tfrac{1}{4}R_{Earth}^2} = 12G\frac{M_{Earth}}{R_{Earth}^2} = 12g$$

You're ejected from your spaceship with some supplies chained to your arm. You and your supplies are slowly spinning. Hungry, you pull your supplies to yourself.

1. As you do so, your linear speed away from the ship increases.
2. As you do so, your speed and your angular speed stay the same.
3. As you do so, you and your supplies spin faster because of conservation of angular momentum.
4. As you do so, your supplies convert into energy.

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1. Decreases
2. Stays the same
3. Increases
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2. Nowhere, energy is not conserved for this system since it is not isolated.
3. The spaceship
4. The work your muscles do in bringing the supplies toward you.

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A black hole has lots of dust orbiting around it called an accretion disk. As the dust slowly inspirals toward the black hole, the dust collides with other dust and lots of energy is liberated as heat and light. Where does this energy come from?

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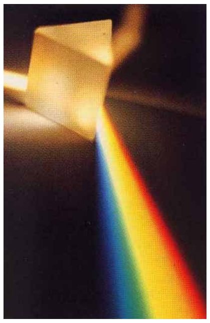
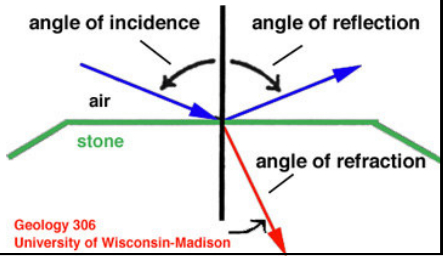


Telescopes and Light

Working w/ Light

- Using geometric optics (approximation) in which light travels in straight lines
- Only thing interesting is at interfaces of two different materials

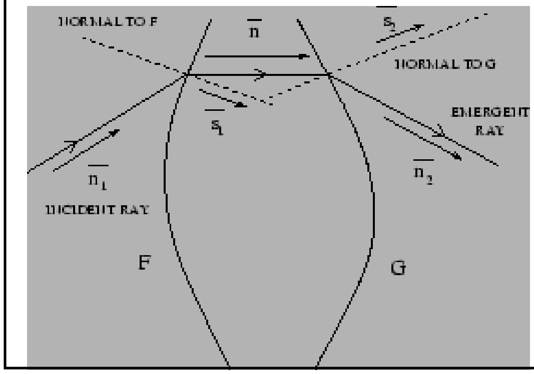


Geology 306
University of Wisconsin-Madison

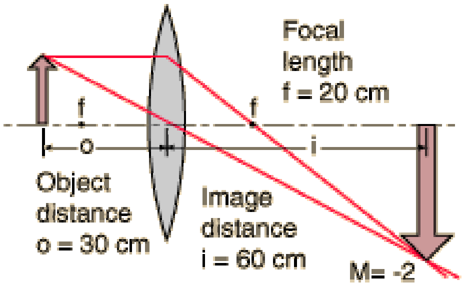
"Bending" of light

- Index of refraction is a property of a material (air=1, water=1.3, glass 1.5)
- We'll do a lab in which we measure the index for water
- Hence, light "bends" which it hits interfaces of these materials
- Lenses refract—if a telescope has lenses, then it's a refractor
- Mirrors reflect—if a telescope has mirrors, then it's a reflector

Thin Lens

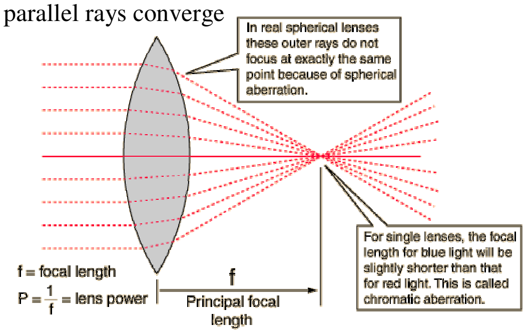


Lens Produces an Image



Lens Has Focal Length

- Focal length—distance from lens where parallel rays converge



Magnification

- Your eye “sees” big image..visualize by extending rays backwards

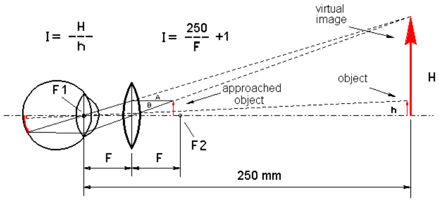


Fig. 4 . The magnifying lens allows objects to be brought closer to the eye while still seeing them clearly. This produces an increase in their apparent size.
F = focal length
250 mm = conventional distance of the near vision

The Telescope

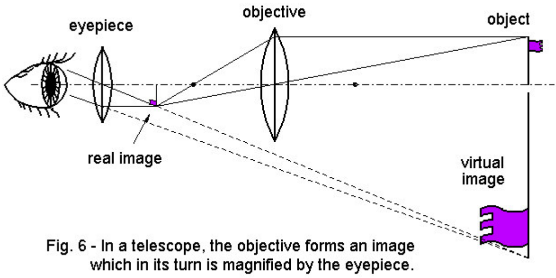


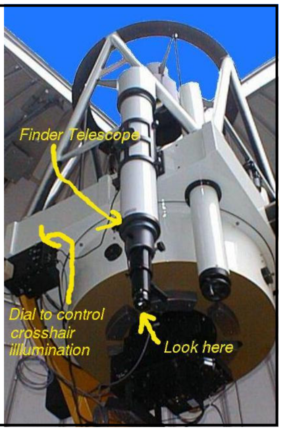
Fig. 6 - In a telescope, the objective forms an image which in its turn is magnified by the eyepiece.

The Finder

- Smaller (wider field) scope to locate objects
- Then you switch to narrow field (main) scope for observations

The Finder

- Not always a small scope:



The Finder

- When you use the telescope, need to make sure that the finder is aligned with the telescope
- Otherwise, very hard to locate objects in the sky
- Aligning during the day:
  - Locate something far away in the main scope
  - Align finder in its mount so that located object is centered
  - Recheck main scope
  - Done.

Telescope Mounts

- Altazimuth
- Equatorial

Altazimuth Mount

- "Usual" mount—swing left/right and up/down
- Birders and land use would call for this
- Not the best adapted for astronomy

Equatorial Mount

- Used for astronomy
- Makes tracking stellar objects easier
- Can also use motor drives

Use of an Equatorial Mount

- The basic idea is to be able to change simply the R.A. and declination of where the telescope points
- Two benefits to this:
  - Can lookup/record celestial coordinates easily
  - Can track objects in the sky easily…simply keep changing R.A. (scopes make this easy)

Use of an Equatorial Mount

- Need to setup the telescope to get the R.A. and declination to "line up" correctly
- At the minimum, "line up" declination:
  - point telescope toward Polaris
  - Set Declination (while it's pointed at Polaris) to +90 degrees (basically telling the scope our latitutde)
- Can also align the R.A. with a star with known R.A. for our latitude