Review for Astronomy Exam

Cosmic Address?

Scientific Method

* Idea
* Hypothesis
* Prediction
* Test

Daily rotation of earth

* Counterclockwise if viewed from north pole, vice versa from south pole
* Celestial sphere
  + Projection of stars, equators, poles, and other things for easier visualizing
  + Sun on ecliptic, which has angle of 23.5 from earths equator
  + Constellations seen on CS, pictured in ancient times. Stars not necessarily close in constellations

Annual orbit of earth

* Vernal and Autumnal equinox: when the sun’s light hits earths equator directly (spring and fall)
* Precession: the earth’s axis of rotation changes, rotating once around a circle in 26,000 years

Monthly orbit of the moon

* Synchronous rotation: orbital period is the same as its rotation period
* Phases of moon:
  + Waxing: increasing in side
  + Waning: decreasing
  + Crescent: larger than half
  + Gibbous: larger than half
* Eclipse
  + Solar eclipse: suns light blocked by moon
    - Total, partial, annular
    - Always occur at new moon
  + Lunar eclipse: earths shadow blocks suns light
    - Always occur at full moon
  + Eclipses don’t occur all the time bc of a 5degree difference in moon/earth/sun orbit

Consequences of above

* Consequence of earth rotation: stars rise and set each day. North Celestial Pole seems to not move, because it’s aligned with the Earth’s rotational axis
  + Stars that don’t appear to set are called circumpolar stars
  + On equator, no circumpolar stars. On NP, yes circumpolar stars
  + If viewed from southern hemisphere, circumpolar stars appear to move clockwise
* Consequences of Earth’s orbital motion:
  + Seasons because axial tilt is 23.5
  + Projected star patterns change

**Issues of astronomy**

Geocentric model:

* Earth at center of universe
* Doesn’t explain retrograde motion of Mars
  + Kind of explained if you put eccentric circles of planets while they orbit

Galileo:

* Heliocentric model confirmed by:
  + Phases of Venus
  + Moons of Jupiter

Kepler’s Law

* 1. Planets orbit in ellipse, sun at one focus
* 2. Equal area/time law
* 3. Relation between semi-major axis and period

Newton’s Law

* 1. Object in motion will stay in motion, object at rest will stay at rest, unless force acts on it
* 2. To change motion, you need unbalanced forces (acceleration)
* 3. Equal and opposite forces (astronaut in space)
* Gravitational Law:

Conservation Laws

* Energy
* Mass
* Mass and energy
* Momentum
* Angular momentum

Energy:

* Potential/mechanical energy switch

Mass and energy:

* E = mc^2

Angular moment

* = MVR (mass of body, velocity of body, distance to center of body)

**Light and Telescopes**

Light:

* Electromagnetic transverse wave
* Properties
  + Wavelength (lamda), amplitude, frequency
* Speed of light
  + *c* is constant
* Wavelength:
  + W = Speed/Frequency
* Also a particle:
  + Composed of photons, who’s energy is dependent on the frequency (x-ray much higher energy than optical)

Telescopes

* Refracting: uses lenses to refract light to a focal point
* Reflecting: uses mirrors to reflect light to a focal point
  + All modern telescopes are reflecting
  + Segmented telescopes for bigger aperture
* Resolution: smallest details that can be seen
  + Limited by light being a wave
  + Resolving power
* Earth’s atmosphere produces turbulence
  + Called astronomical “seeing”
  + This is why we want telescopes to be as high up as possible
  + Adaptive optics can also be used to correct for “seeing”
* Want telescopes in areas with little light pollution
* Radio telescopes
  + Want as large an aperture as possible
  + Can use arrays of telescopes for interferometry to “create” an aperture

Photography

* Moving from eyes to CCDs now
* CCDs are high-level detectors

Spectrums:

* Dispersing light to learn more about an object (temp, element composition)

Electromagnetic spectrum

* All waves possible

Nearly all X-ray, ultraviolet, and infrared wavelengths blocked by atmosphere

Star formation

* Molecular clouds collapse and fragment into cores
  + Collapse due to their own gravity
  + Angular momentum conserved, so a accretion disk forms
  + Constantly changing energy
  + Nuclear fusion begins turning hydrogen into helium, and star is formed
  + <.08 in mass are called brown dwarfs, nuclear fusion never starts
* Accretion disk
  + Full of dust and particles
  + Planets form in high density areas, starting very small as planetesmals which get larger
  + Hotter on the outside of disk, cooler on inside
    - Outer has volatile materials
* Planets gather gases from the disk
  + Creates primary atmosphere
* Extra-solar Planets
  + Pulsar timing
  + Radial velocity
  + Transient method
  + Direct imaging
    - Most extra-solar planets are Neptune size