PHYS 1901 Midterm Review 23-10-15

Chapter 1

Universe: Everything Astronomy: Study of the Universe

Scientific Method: - A methodical approach
- Composed of observations used to create a better understanding of the Universe

Observations -> Theory

Theory: Ideas + Assumptions (Framework)
->Into a model: To explain and predict
Can be amended to further understanding

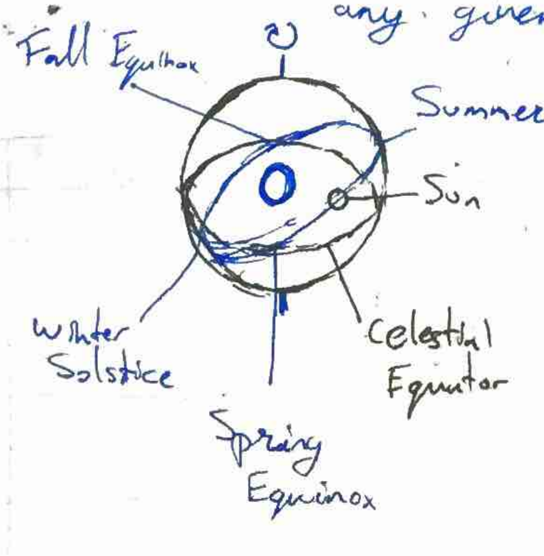
Characteristics:
Testability; Continual testing; Consistency (how well it holds up with new observations)
Simplicty (logical)

Constellations: Patterns of stars visible to the naked eye appear to be projected on celestial sphere

Celestial Sphere: The plane on which the stars appear from Earth

Solar Day: Time from noon to noon (~359°)

Sidereal Day: Time from two consecutive rising of any given star (360°)



Triangulation: used for measuring distances

Paralax: Apparent [movement of an object] in the foreground relative to background

Chapter 2

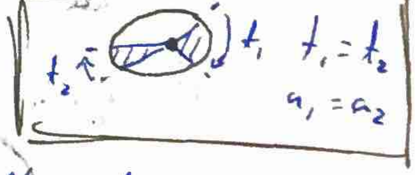
Geocentric: where Earth is at the centre
- Ptolemaic Model (greeks) (Plato, Aristotle)
- Needs Retrograde motion to work (Epicycles)
- More complicated as new observations were made

Heliocentric: where the Sun is at the centre
- Copernican Model (1500's)
  - Not everything orbits the same thing
  - Stars very far away
  - Still needed epicycles since it assumed perfect circle orbits

Galileo: Observed: Sun, Venus, Jupiter
- Played a crucial role in supporting the Heliocentric / Copernican model
- Saw Venus had phases just like the Moon
  - This could only be explained if [Venus orbitted the Sun]
  - If Venus orbits the Sun, [why can't the Earth
  - Observed 4 Moons of Jupiter →

Kepler:
3 Laws of Planetary Motion
- He improved on Copernicus' model (accurate)

1 - Planets orbit in [ellipses]
2 - Area swept in equal time →
3 - $T^2 \propto a^3$ T(period), a (distance)



Newton: Explained Keplers laws with Mathematics
1 - $p = mv$ (... stays in motion)
2 - $F = ma$ (force causes acceleration)
3 - ... equal + opposite reaction

Proposed: Gravity: held planets in orbits

Chapter 3/4

Light: EM Waves, $c = 3\times10^{8}$ m/s, but also a particle

Blackbody Curve: As an object is heated, the radiation it emits peaks at higher frequencies
1800s - Scientists puzzled
- There should be more radiation at gamma ray end
- Solution: Quantum mechanics
(Quanta, energy packets)

Quantum Mechanics: Predicts blackbody curve
- Relationship between (Temp. + f_{peak})

Blackbodies Curves - Used to measure temperatures of Stars

"Probabilities"

Atoms: - electrons move down orbitals: light emitted
- they move up when hit with photon (absorb light)
- This is used to idenify elements
(Emission/Absorbtion lines) Spectral lines

Diffraction:
How light bends around an object

Doppler Effect: Wave shift due to movement
- Broadens Spectral lines
- But also compresses/expands them
-> this can be used to tell how fast they are moving away from us

Photoelectric Effect: Einstein explained it with quanta
$E \propto f$ (more energy = higher frequency)

Emission Spectrum: Total wavelengths emitted by a hot gas
- May be only a few lines Emission lines
Same as the Absorbtion lines of the same gas cooled

Chapter 5

Optical Telescopes

Refracting: use lenses to focus light (Different wavelength travel at different speeds "Rainbow")

Reflecting: use mirrors to focus light

Large telescopes mean greater Resolving Power
- Seperature images of object close in field of view
- limited by Diffraction [angular resolution $\propto \frac{\lambda}{d_{mirror}}$]

Small resolution = good resolution

Obstacle: Atmosphere interferences with light (Twinkling Stars)
- light pollution

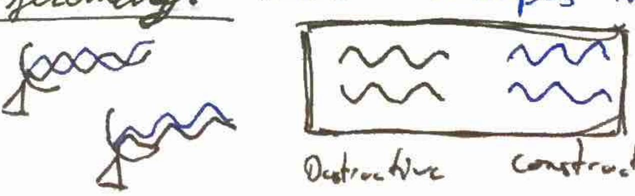
Adaptive Optics! - correct noise in Real time
- compensate for vibrations + thermal fluctuations
- May use a laser to create an artificial star
- to gauge atmosphere.

Radio Astronomy: Uses wavelengths longer than light
- Thus less atmospheric interference
- Lacks angular resolution

21cm Line: When H atoms switch from ↑↓ ⟷ ↑↑
- Emits radio wave of $\lambda = 21cm$

This permeates gas clouds that are opaque to light.
-> Allows astronomers to see inside

Interferometry: Radio telescopes in tandem



This allows for [greater resolution]

Space Astronomy: Atmosphere blocks many wavelengths
UV does not get past atmosphere mostly
· Higher energy ~~too~~ harder to focus
gamma rays: observed by collision in atmosphere
- collision reconstructed

Neutrinos: ~~an~~ elementary particle, weakly interacting
- Useful to understand Super Nova

According to Einstein:
- gravity waves are a thing

Chapter 6

~~[illegible]~~:
Comparative Planetology: ~~to~~ help understand origin of:
- Solar System
- Earth history
- planetary evolution / formation

Distances to Planets: known using - Kepler's + Newton's Laws
- Radar ranging

Sizes: known using angular size

Masses: known using Newton's Laws + perturbations
- Now: satellites

All planets: Rotate CCW from Celestial North Pole

Terrestial Planets: Composed of mostly "metals"
- All have an atmosphere
  - Mercury little, Venus lots, Earth.., ~~Mars~~ Mars little

few ~~moons~~. Mercury + Venus slow, ~~~~ rotation (Venus: retrograde)
  - Earth + Mercury magnetic fields

Jovians: Gas Giants
- No solid surface Strong Magnetic fields
  Many moons., and rings

Interplanetary Mass < Mass of Moon
most in kuiper belt

Spacecraft Exploration: Began in 1960s