Astronomy 110G Review

The Celestial Sphere

- Astronomical Objects: Sun, Moon, Planets,...
- Motions: Diurnal,Annual, Direct & Retrograde, ...
- Phenomena: Seasons, Phases, Eclipses, Tides, Brightnesses, ...

Mediterranean Astronomy

(~600 BCE to ~400 CE)

- Interpretation & Explanation: Pythagoras, Aristotle, Ptolemy,...
- Measurements: Aristarchus, Eratosthenes, Hipparchus,.., ...
- Models: Aristotle, Hipparchus; the Ptolemaic Model

European Astronomy

(from ~1500)

- The Copernican Revolution: Copernicus, Digges,...
- Observation & Measurement: Tycho, Galileo, Kepler, ...
- Beginnings of Astrophysics: Galileo, Newton, ...
- Light & Atomic Physics: Inverse Square Law, Doppler Effect, Spectra of Solids, Liquids, and Gases,...

Astronomy 110G Review

Astronomy + Physics = Astrophysics

- Newtonian Mechanics: "Newton's Laws"
  - Mass & Forces; Velocities and Accelerations
  - Mathematical Tools: The Calculus
- Newtonian Gravity: " The Law of Gravity"
  - Orbital Motions and Kepler's Laws
  - Gravity and Tides
  - Other Gravitational Phenomena
- Electromagnetic Radiation: "Light"
  - Measuring Light: Direction, Intensity, and Color
  - Photons and Waves: Energy & Momentum; Wavelength & Frequency
  - Light in Space: The Speed of Light; The Inverse-Square law
  - Light and Motion: Light as a Wave: he Doppler Effect
  - Electromagnetic Spectrum: From Gamma Rays to Radio Waves
  - Optics: Reflection & Refraction; Dispersion & Diffraction
  - Light & Matter: Emission, Absorption, and Scattering; Stimulated Emission
  - Spectra: Continuous and Line Spectra; Atomic Physics

Astronomy 110G Review

The Solar System

- Constituents: Sun,Planets & Satellites, Meteors & Comets, KBOs & TNOs, Interplanetary Dust & Gas
- Orbits and Orbital Motions: Orbital Elements P, a, ε, i, ... Commonalities, Similarities, and Differences
- Physical Properties: Mass, Size & Shape, Mean Density, Age, Rock, Ice, and Gas: Jovian & Terrestrial bodies Rotation. Interiors, Surfaces, and Atmospheres
- The Age of the Earth: Radioactivity & Age-Dating of the Earth, the Moon, the Asteroids, and Mars. Age of the Sun?
- Planetary Structures: Interiors, Surfaces, and Atmospheres Processes: Accretion and Differentiation
- Origins of the Solar System: Sun & Planet Formation Theories; Explanations, Tests, and Predictions
- Evolution of the Earth: Differentiation and the Interior; Continental Drift; Evolution of the Atmosphere: Life on Earth.

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Stellar Astronomy

- Star Distances: Parallaxes (Trigonometric, Photometric, Dynamic,..
- Stellar Motions: Radial & Tangential Velocities, Proper Motions ...
- Stellar Photometry: Luminosity & Color, Spectra, Temperatures,..
  Systematics: The Hertzsprung-Russell Diagram.
- Stellar Properties: Radius, Mass, Composition (Spectra)
  Binary Stars (Masses & Radii)
  Systematics: The Mass-Luminosity Relation.
- Stellar Structure: Energy Production *via* Thermonuclear Fusion
  Main Sequence "Hydrogen Burning"
  Radiation, Convection (& Conduction)
- Stellar Evolution: Star Formation
  Main Sequence Structure & Evolution
  Giants & Supergiants; Supernovae
  White Dwarfs, Neutron Stars, Black Holes

Astronomy 110G Review

The Milky Way Galaxy

- Inventory: Appearance. Stars, Clusters & Nebulae; Dust & Gas
- Mapping & Motions: Stellar Motions. Globular Clusters.
- The Dust Problem: Extinction & Reddening of Starlight
  Radio Astronomy: Mapping the Neutral Hydrogen
- Galactic Structure: Disk (Rotation), Halo (Globular Clusters), Bulge
  Spiral Structure & Star Formation; Population I & II
- Galaxy Formation: Cloud Collapse or Accretion?

Galaxies: Island Universes

- Spiral Nebulae: Galaxy Distances and "The Great Debate"
- Galactic Morphology: Hubble Types: Structure, Motion, Contents
- Galaxy Distances: Techniques
- Galaxy Masses: Masses from Motions. "Dark Matter"
- Galaxy Associations: Satellites, Galaxy Clusters, and Larger-Scale Structures. Dark Matter Again

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Cosmology

- Fundamental Observations: The Hubble Expansion & Ages
  Olbers' Paradox & Ages
- Interpretations: An Expanding Universe of Finite Age
  Linear & Isotropic Expansion:The Hubble Constant
- Explanation & Prediction: The "Big Bang" Cosmologies
  Theory: Einstein's General Relativity
  The Cosmic Background Radiation
  Cosmic Abundances of the Elements
  Density & Temperature History of the Universe
  The Development of Structure (& Dark Matter)
  The Future of Our Universe
- Questions & Issues: Puzzlements
  Dark Matter & Dark Energy
  Starting the Expansion. Inflation?
  Multiverses?