

- Ch. 16: The Milky Way Galaxy
 1. Shape
 2. Size 100 ly, we're 2/3 of the way from the center
 3. Structure: spiral arms, disk, bulge, halo
 4. Mass and Age
 5. Pop I and II stars
 6. Open and Globular clusters
 7. ISM—interstellar matter, scattering
 8. Two Spiral Arm models
 9. Galactic mass...Kepler's, rotation curve, dark matter
 10. Galactic center
 11. Galactic formation/evolution
 12. Pop III stars
 13. Our galactic neighborhood: Large/Small Mag. Clouds, Andromeda
- Movie: *Monster of the Milky Way*
 1. Our “view” of the galactic center
 2. Stellar orbits about central region
 3. Mass and size determination
 4. Flares of Sag A*
- Ch. 17: Galaxies
 1. What makes a galaxy a different galaxy?
 2. Roughly when were galaxies understood as distinct?
 3. Basics of galactic types: spiral, elliptical, irregular
 4. More galactic evolution: collisions and mergers
 5. Cosmic distance ladder: parallax, Cepheids, Type Ia supernovae, Tully-Fisher
 6. Hubble's Law
 7. Dark matter: what it might be, why we think its out there, where is it, etc
 8. AGN: radio, Seyfert, quasars
 9. Sizes based on light variability
 10. Structures bigger than galaxies: various cluster types, voids, walls

- Ch. 18: Cosmology
 1. The Universe: isotropic, homogeneous
 2. The Big Bang
 3. The Universe: age, center
 4. Cosmic horizon
 5. CMB: temperature, what is it, perfection versus anisotropy, history
 6. Big Bang Nucleosynthesis
 7. Fate of the universe: open, closed, flat
 8. Density, critical density, importance for fate
 9. Surprising acceleration: different than expected, repulsion, dark energy
 10. What it means for the universe to be curved
 11. Basics of big bang history: as universe cooled, more and more structure
 12. Inflation: problems it solves, how it does so

- Essay 4: Life in the Universe
 1. Life on Earth:
 - (a) Timeline: developed fast, meteorites affect things, humans recent phenom.
 - (b) Origins: panspermia versus arising from heat/lightning plus chemistry
 - (c) Commonality: elements, amino acids, proteins, ATP, DNA
 - (d) Common origin: chemical reactions
 - (e) Evolution: three key ingredients
 2. Life elsewhere
 - (a) Probability: Drake equation
 - (b) Fermi Paradox: Where are they? and Possible answers
 - (c) Search for: SETI, Voyager probes
 3. Anthropic Principle
 - (a) Method of answering questions
 - (b) Method of last resort; often not appropriate
 - (c) Conditions on Earth could be extremely rare