

# Test Four Preview

## AST 102 Stars, Galaxies, Universe—Lecture Classes

The Course Outline is very helpful for this part as it is especially detailed. Since I am skimming over some of the final units, I will reprint the Course Outline here, slightly reduced to help you focus on what you really need to know.

- Chances for ETL - life in the universe (textbook)
- Galaxies
  - our Milky Way galaxy--a typical spiral galaxy
    - Harlow Shapley & Henrietta Leavitt
      - the Cepheid variable P-L relation
      - size and our location
    - structure from radio and optical studies
    - the galactic year
    - origin and explanation of stellar population types
  - other galaxies
    - morphology types
    - clusters and superclusters
    - quasars--the mystery
- the Universe--origin, nature, future
  - Important cosmic discoveries of the 20th century
    - the expansion of the universe
      - quasars--the mystery solved?
    - the 2.7 K Cosmic Microwave Background (CMB)
      - recent: very minute, but important fluctuations in the CMB
    - Recent discovery of an acceleration of the universe's expansion
    - an approximate inventory of the universe's matter, dark matter, and dark energy
    - Age of the universe
  - The major theories on the origin of the universe
  - The logic behind the theories
    - the Steady State Theory
    - the Big Bang Theory
      - Inflationary Universe Theory — a BB theory "upgrade"

- the starting size of the universe
    - the “flat” universe
    - speculation that the origin was a QM statistical fluctuation from a non-zero "energy vacuum"
  - the first 3 minutes
    - origin of the fundamental forces
      - Grand Unification Theories (GUTs)
    - origin of the elementary particles
    - the brief period of fusion
  - the time of "recombination"
    - the de-ionization of the universe and the decoupling of matter and light energy; explanation of the CMB
  - the origin of the galaxies - a major puzzle
    - discovery of the earliest fluctuations?
  - the Oscillating Universe Theory
    - Is the universe open or closed? Finally, it appears we have an answer
    - Dark Matter and Dark Energy
  - String Theory a.k.a. “The Theory of Everything”
    - Are there 7 more dimensions?
- Evidence supporting the Big Bang
    - the expansion of the universe
    - the 3 K CBR
    - the faraway distribution of QSOs
    - the cosmic abundances of He and D
    - the W and Zo particles of the electroweak force
    - the very small fluctuations in the early universe ( $\pm 30 \times 10^{-6}$  K)
    - the darkness of the night sky — Olber's Paradox
    - evolution of the galaxies
  - Speculation that the BB was a result of a collision of universe “branes”