Dr. Bash **Review for Second Exam** **AST 301**

- Required Reading – Textbook
  Chapters 9, 10, 11, 12, 13, 14 15, 2, 3

- Important Lecture Material

How Stars Work

equilibrium, entirely gaseous
perfect gas law
hydrostatic equilibrium
thermal equilibrium

- Heat Transfer
  conduction
  convection
  radiation
  opacity

- Energy Sources
  gravitational collapse energy
  nuclear energy (fusion)
  $E=mc^2$
  specific reactions

P-P chain	H→He
CN cycle	10 million° K
Helium burning	He→C
	100 million° K
Carbon burning	C→O, Mg, S
	600 million° K
last possible:	up to iron

How Stars Evolve

- Star Formation (Protostars)
  collapse to the main sequence
  limits to stellar masses
- Main sequence evolution
- Leaving the Main Sequence
- Helium Flash
- Post-Helium Flash
- Compare all this to Clusters
- Stellar Death
  white dwarfs
  neutron stars, supernovae, and pulsars
  black holes

The Galaxy

- Shape, size, and our location in it
- The sun's orbit in the Galaxy
- The Galaxy's mass
- The gas and dust between the stars
- Neutral hydrogen and the 21-cm line
- The spiral structure
- Stellar populations
- Star clusters

Galaxies

- Types of galaxies
- Spirals and barred spirals
- Ellipticals
- Irregulars
- The approximate ranges of masses, sizes, and luminosities of each type
- The stellar populations of each
- Clusters of galaxies
- Galaxies as radio sources
- Formation of galaxies

Cosmology

- Olber's Paradox
- Expansion of the universe and Hubble's Law
- The age of the universe
- General theory of relativity
- Cosmological principle
- Perfect cosmological principle
- Evolutionary and steady-state cosmologies
- How the universe ends (closed, open, flat)
- Observational tests

Old-Fashion Astronomy

- Motions of the stars across the sky as seen from different latitudes
- Time
- Why different stars
- The seasons and why it gets dark early in winter
- The phases of the moon
- Rotation of the moon
- The calendar

Dr. Bash **Questions for Exam #2** **AST 301**

1. The Sun is a main-sequence star. Where did the calcium that we see on the Sun's surface come from? Prove that the sun could not have made it.

2. Cite the evidence that all globular star clusters are old.

3. Why are main-sequence stars so much more common than red giants?

4. Since all stars smaller than about two solar masses evolve into white dwarfs and since such stars are so plentiful, why don't we see billions of white dwarf stars?

5. Imagine that the temperature of the center of a star is suddenly increased. What will happen and why?

6. In the Big Bang Theory of the origin of the Universe, *why* do distant galaxies have large velocities of recession?

7. In spiral galaxies one finds regions of ionized hydrogen containing very hot stars strung out like beads along the spiral arms. What implications does this have for star formation?

8. Can a red main-sequence star be young? Explain fully.

9. Population II stars are expected to form in a collapsing cloud of gas after the Population III stars have died. This collapsing cloud marks the formation of a galaxy. Compare the luminosity of elliptical and spiral galaxy of the same mass at this stage.

10. Why will most stars die as white dwarfs?

11. In the Big Bang Theory, how do we estimate the age of the Universe?

12. Why don't elliptical galaxies have disks full of Population I stars?

13. Why doesn't a white dwarf star collapse as it cools?

14. Remembering only how the main sequence lies in the H-R diagram, how can you prove that main-sequence O stars are burning their hydrogen much faster than main-sequence M stars?