**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 Evolv*e

- 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