ASTR/PHYS 1060 Final Exam Study Guide

Midterm 1 Material (~30%)

Sun, Moon, and Earth

- How does the night sky change based on your location on the Earth?
- Why do stars rise at different times during the year?
- What causes the seasons?
- What causes solar and lunar eclipses?
- How do lunar phases work?

Kepler, Newton, and Orbits

- What are Kepler's 3 laws?
- What are Newton's 3 laws?
- How does Newtonian gravity work?
    - How does its strength depend on the masses of objects?
    - How does its strength depend on the separation of massive bodies?
- What's the difference between bound and unbound orbits? What critical value separates them?

Light and Telescopes

- What are the different wavelength regimes (radio, X-ray, etc.) of the electromagnetic spectrum? How does the transparency of the atmosphere vary for them?
- What is the difference between a blackbody spectrum, emission lines, and absorption lines? How are they produced?
- What is the Doppler shift? How does it cause light to get redshifted and blueshifted?
- What is the diffraction limit of a telescope? What does it imply for telescopes working in different wavelength regimes?
- What's the difference between a refracting and reflecting telescope? Which do professional astronomers use today? Why?

Formation of Stars and Planets

- What causes gas clouds to form stars?
    - Why do they form disks?

    - Why do they get hot (before fusion begins)?
- How do planets form around stars? What evidence do we have of that?
- What techniques do we use to find planets around other stars? How do they work?

Midterm 2 Material (~30%)

Stars

- What does the spectrum of a star look like?
- How do we identify the elements that make up a star?
- What determines how luminous a star is? How is luminosity related to color and size?
- What is parallax and how does it work?
- What is the H-R diagram?
    - Where do stars sit on the diagram during different phases of their life?
    - What fundamental property determines a star's position on the diagram and how it evolves?
- Why do stars shine?
- How long do different types of stars live?
    - What fundamental property determines their lifetimes on the main sequence?
    - What forces balance each other to keep stars stable on the main sequence? What generates those forces?

Low Mass Stars

- How is fuel burned in a star?
- What are the phases in the life of a low mass star? What process defines each stage?
- What elements are made over the course of their lives, and how do those elements get returned to gas in interstellar space?
- What is a white dwarf?
    - Why doesn't it collapse into a black hole?
    - What is the Chandrasekhar mass?
- In close binary stars, what is the Roche lobe?
- What happens when a star fills its Roche lobe if it's companion star is a white dwarf?

High Mass stars and their Remnants

- What are the phases in the life of a high mass star? What process defines each stage?
- What elements are made over the course of their lives, and how do those elements get returned to gas in interstellar space?
- What is a neutron star? Why doesn't it collapse into a black hole?
- What is a pulsar? Why does it have a high rotation speed?

- What is a black hole? How massive can they get?
  - What is the event horizon?
  - What is Hawking radiation?
  - How do we observe black holes in the universe?

Post Midterm 2 Material (~40%)

Measuring Galaxies

- What is the distance ladder? What are different methods for estimating distances in astronomy, and roughly over what distances to they work?
- What main types of galaxies are there? How are they different?
- What is Hubble's law, and what is it a measurement of?

Our Galaxy, the Milky Way

- How big is the Milky Way? Roughly where is the Sun in the Galaxy? How did we discover that?
- What makes it difficult to study the Milky Way?
- What evidence do we have that there must be dark matter in the Galaxy?
- How do supernovae effect the Galaxy?

Cosmic Microwave Background and the Big Bang

- What is the Big Bang? What observation implies it must have happened in the distant past?
- What is the cosmic microwave background? How did it come about?
- What is the origin of the temperature fluctuations in the CMB?
- What is dark matter? What observations (besides in individual galaxies) tell us it exists?
- What is dark energy? What observations tell us it exists?
- What is the fraction of dark energy and the different matter components in the current universe?
- What are the flatness and horizon problems?
- What is inflation?

Large-scale Structure of the Universe

- How do we make maps of the largest structures in the universe?
- What do those structures look like?
- How do those structures grow over time? What causes them to grow?
- What do observations of their growth imply about the type of dark matter that exists?

- What do the measured cosmic abundances of deuterium and helium imply about the amount of baryonic (normal) matter in the universe? Does this imply the existence of dark matter? Why?
- What will the universe look like many quadrillions of years from now?

Life Beyond Earth

- Why is life on Earth based on carbon atoms? Could another atom have served as the basis for life?
- What are the minimum requirements of life (like that on Earth)?
- What is the habitable zone around stars? How is it affected by the type of star?
- What is the Drake equation? What are some of the terms in it?
- What is SETI?
- What is the Fermi Paradox? What are some solutions to the paradox?
- What are Dyson Spheres?