Topics for Jan 19-21

To order-of-magnitude accuracy, know the relative sizes of Earth, Sun, Solar System, Milky Way Galaxy, Universe

Understand the meaning of scientific notation

and how to add, subtract, multiply, and divide

numbers in scientific notation

Know how the angular size of an object is related to its

size and distance

Understand the meaning of the phrases ‘proportional to’ and ‘inversely proportional to’

Know what the magnitudes of stars tell you about

their relative brightnesses

Topics for Jan. 24-28

Describe the apparent motions of stars across the sky during a night as seen from various locations on Earth

Describe and explain the apparent motion of the Sun relative to the stars during a year

Explain how the tilt of the Earth's axis causes the seasons

Describe how the path of the Sun across the sky during a day differs during different seasons

Describe and explain the phases of the Moon and the motion of the Moon relative to the stars during a month

Explain how eclipses occur

Topics for Feb. 0-4

Describe the models of Aristotle, Copernicus, and Kepler. How correct and how accurate was each? How did each explain retrograde motion of the planets?

State each of Kepler's 3 laws and be able to use them to compare speeds of different planets and of one planet at different points in its orbit.

What arguments did Galileo make in favor of the Copernican model?

What did Newton add to our understanding of Kepler's laws?

State Newton's 4 laws. Know what the words in each mean. Apply them to the problem of falling balls.

Topics for Feb. 7-11

What is a photon? What is an electromagnetic wave?

How are the photon and wave pictures of light related?

Make a sketch of an atom, showing its parts.

How do the wave properties of electrons result in only certain electron orbits being allowed in an atom?

How does the fact that only certain electron orbits can occur result in photons of only certain wavelengths being emitted?

Describe emission and absorption line spectra and the conditions under which each occurs.

Describe black body radiation and the relations between temperature and the power emitted and the wavelengths of light emitted.

Describe the Doppler shift.

Topics for Feb. 14-18

How does the Sun generate the energy that is radiated from its surface?

Describe the first reaction in the chain of nuclear reactions in the Sun.

What is the overall result of the nuclear reactions in the Sun?

How does Einstein's equation, $E = m c^2$, help explain how nuclear reactions generate energy?

Describe how neutrinos allow us to observe the interior of the Sun, and say what was found.

Topics for Feb. 21-25

Describe how astronomers measure temperatures of stars.

How do astronomers use parallax to measure the distances to stars? Why does parallax vary inversely with distance?

Describe and explain the relationship between a star's apparent brightness (or flux), its absolute brightness (or luminosity), and its distance from us.

Describe and explain the relationship between a star's luminosity, its radius, and its temperature, and how this relationship is used to measure radii of stars.

Sketch an H-R diagram, showing the location of main sequence stars, red giants, and white dwarfs.

Explain how astronomers measure masses of stars.

Describe how the luminosities of main sequence stars are related to their masses.

Topics for Feb. 24-28

Explain how astronomers measure masses of stars.

Describe how the luminosities of main sequence stars are related to their masses.

Describe the process of formation of a protostar from a molecular cloud.

Describe the concept of hydrostatic equilibrium.

Describe the concept of thermal equilibrium.

Describe how a star changes if it is not in thermal equilibrium, and how this keeps the Sun's luminosity stable.

Describe how the mass-luminosity relation can be used to calculate the lifetimes of main sequence stars.

Topics for March 3-7

Describe how the mass-luminosity relation can be used to calculate the lifetimes of main sequence stars.

Describe the changes that occur near the center of a star as it changes from a main-sequence star into a red giant.

Describe how a red giant becomes a planetary nebula and a white dwarf.

How does the pressure inside a white dwarf differ from normal gas pressure?

How does nuclear fusion inside of very massive stars differ from the fusion that will occur inside of the Sun?

How do the processes that occur inside of massive stars lead to supernova explosions?

Topics for March 17-21

Compare the two types of supernova: how do they differ in the cause of the explosion and in what is left behind?

Describe neutron stars.

Describe pulsars.

Why do neutron stars rotate so quickly?

Why couldn't white dwarfs or other stars rotate as quickly?

Define 'escape speed'.

Describe black holes.

What evidence do we have that there is a very massive black hole at the center of the Milky Way?

Final Exam

The final exam is at 2:00 on Monday May 12
in JES A121A.

It will cover the entire course, with an emphasis on the last 6 weeks.

You must bring your UT ID.

Topics for March 24-28

Describe the Milky Way Galaxy

Describe the Standard Candle method of determining distances and how Cepheid variable stars are used as standard candles.

Describe how astronomers measure the distribution of mass in the Milky Way and what they find.

Explain why we might expect the spiral arms in the Milky Way to become more tightly wrapped and how density wave theory solves this problem.

Topics for March 31 – April 4

How do spiral, elliptical, and irregular galaxies differ?

What does Hubble's law say?

How is Hubble's constant measured?

Describe some of the results of galaxy collisions and mergers.

What is meant by the phrase 'active galaxy'?

What evidence do we have that active galaxies have very massive black holes at their centers?

Topics for April 7-11

How does the big bang theory explain Hubble's law?

How does the big bang theory explain the microwave background radiation?

Describe some of the events that occurred in the first few minutes after the big bang.

Describe how supernovae are used to measure the rate of expansion of the Universe in the past.

Describe how matter and energy cause the expansion of the Universe to accelerate or decelerate.

Do we think the Universe is finite or infinite?

Do we think the Universe will eventually collapse or expand forever?

Topics for April 14-18

What evidence do we have that planets exist orbiting around other stars?

Describe and compare briefly the compositions and orbits of the planets, asteroids, and comets.

Describe the nebular theory of the formation of the solar system.

How does the nebular theory explain the differences in composition among the planets?

Topics for April 21-25

How can we use the concept of thermal equilibrium to calculate the temperature of the surface of a rock orbiting the Sun?

How does the result depend on the distance of the rock from the Sun?

How does the Earth's atmosphere affect the surface temperature of the Earth?

Why do Venus and Mars have such different surface temperatures?

How are we changing the Earth's atmosphere, and how do we think this will affect the surface temperature?

Describe our current theory of the formation of the Moon and the evidence we have supporting this theory.

Topics for April 28-May 2

How does the idea of escape of gasses help explain the differences between the atmospheres of the different planets?

What evidence do we have that leads us to conclude that different planets and moons have different compositions?

How did planets get rings?

What are meteors, meteorites, and asteroids?

What are comets, and why do they look like they do?