Basic Astronomy - things to have at your fingertips

- Diameter of Earth $\approx$ 8000 miles; circumference of Earth = 24,900 miles

- Mean Earth-Sun distance (1 Astronomical Unit) = 92.9 million miles

- Speed of light $\approx$ 300,000 km/sec $\approx$ 186,000 miles/sec

- 1 light-year = *distance* light travels in a vacuum in one year

- 1 parsec ("parallax of a second of arc") = 3.26 light-years = 206265 Astronomical Units

- Nearest star (after the Sun) is Proxima Centauri (4.3 lt-yrs away)

- The brightest star in the night sky is **Sirius**.

- Seasons on Earth are caused by the $23\frac{1}{2}$ degree tilt of the Earth's axis of rotation to the plane of its orbit

- Age of solar system $\approx$ 4.6 billion years

- Age of universe $\approx$ 13.7 billion years

- First quarter Moon is 90 degrees east of Sun, so first quarter Moon rises about noon, is highest in the sky at sunset, and sets about midnight.

- Full Moon is opposite Sun, so full Moon rises at sunset, is highest in the sky at midnight, and sets about sunrise.

- Third quarter Moon is 90 degrees west of Sun, so rises about midnight, is highest in the sky at sunrise, and sets about noontime.

- A *lunar* eclipse happens when the full Moon enters the Earth's shadow.

- A *solar* eclipse happens when the new Moon covers part (or all) of the disk of the Sun.

- A planet's orbit is an ellipse, with the Sun at one focus (Kepler's First Law of planetary motion).

- An object orbiting the Sun on an elliptical orbit moves fastest along its orbit when it is closest to the Sun and most slowly along its orbit when the distance is greatest. This is in agreement with Kepler's Second Law of planetary motion.

- The periods (p, in years) of the planets are related to the orbital sizes (a, in AU) as follows: $p^2 = a^3$. This is Kepler's Third Law of planetary motion. In this form it applies to planets orbiting a 1 solar mass star.

- The magnification of an optical telescope is equal to the focal length of the primary objective (F_o) divided by the focal length of the eyepiece (F_e).

• All kinds of light, from gamma rays through radio waves, move at the same speed (300,000 km/sec) through a vacuum.

• A hot solid, liquid, or dense gas emits a *continuous spectrum.* The wavelength of the maximum intensity is related to the temperature of the material. Example: cannon ball at 3000 deg K. Peak intensity is in the near-infrared.

• A low density gas excited to emit gives an *emission line* spectrum. Example: neon light.

• Cool gas in between the observer and a source of a continuous spectrum gives an absorption spectrum. The absorption lines indicate the composition of the cooler gas along the light of sight. Example: spectrum of the Sun or most any other star.

• An object that shows emission or absorption lines will have lines shifted toward longer wavelengths if the object is moving away from the observer. These are called redshifts.

• An object that shows emission or absorption lines will have lines shifted toward shorter wavelengths if the object is moving towards the observer. These are called blueshifts.

• Hydrogen is the most common element in the universe. A neutral atom of hydrogen contains one proton (the nucleus) and one orbiting electron.

• Cold atomic hydrogen gas (e.g., 50 deg above absolute zero) emits radio waves at a wavelength of 21 centimeters.

• A main sequence star converts protons into helium nuclei in its core. 0.7 percent of the mass of the protons is converted into energy according to Einstein's formula $E = m c^2$.

• The Sun will be a main sequence star for a total of about 10 billion years.

• The Sun will eventually become a white dwarf star, a bit larger than the diameter of the Earth. It will *not* explode as a supernova.

• The visible portion of the Milky Way Galaxy is about 75,000 lt-yrs in diameter. The solar system is about 26,000 lt-yrs from the center of the Galaxy.

• For galaxies at distances greater than about 100 million light-years the velocities of recession are proportional to the distance. This is known as Hubble's Law: $V = H_0 D$, where H_0 is the Hubble constant, about 72 km/sec/Megaparsec. Nearby galaxies are more strongly affected by gravitational attraction of other nearby galaxies.