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ENVI.2020 - PRINCIPLES OF EARTH & ENVIRONMENTAL SYSTEMS I

STUDY QUESTIONS II

ORIGIN OF THE UNIVERSE AND THE SOLAR SYSTEM

1. Explain the difference between emission and absorption spectra. How can we use these spectra to determine the chemical compositions of stars and galaxies?
2. We are observing a distant galaxy with an optical telescope. We measure the EM radiation coming from a star in this galaxy and find that the wavelength of maximum energy occurs at 0.2 μm.

a. Calculate the temperature of the star.

b. Calculate the energy emitted per unit surface area.

1. When referring to light coming from distant stellar objects, what is a “red shift” and what does it tell us? What is a “blue shift” and what does it tell us?
2. When looking at the data for the star we were observing in Question 2, we find that there has been a shift in the wavelength of the spectral lines for hydrogen. In the laboratory we find that when an electron moves from the second energy level to the first energy level the emitted energy has a wavelength of 1.21567×10−7 m. In the case of the spectra from the distant star the measured wavelength is 1.43225 x 10-7 m. Calculate the velocity of the star relative to the earth. Is the star moving towards us or away from us? To calculate velocity use the following equation:

v = the velocity of the distant star

λ = the wavelength emitted when the electron moves from one energy level to another

Δλ = the difference between the measured wavelength for the distant object and the laboratory wavelength

c = the speed of light in a vacuum = 3.0 x 108 m/s

1. How and why has the abundance of hydrogen in the universe changed since the Big Bang?
2. How do we know that the sun is at least a *second generation* star?
3. What are the key factors that will determine if the universe expands forever or if this expansion will stop, and perhaps contraction will occur.
4. Compare and contrast the inner and outer planets of the solar system.
5. What are the two major types of meteorites? Which is more abundant? Why do we think meteorites can tell us something about the composition of the Earth?