PHYSICS 113
Assignment #7
SOLUTIONS

Chapter 13

18. Suppose an astronomer told you she had found a type O main sequence star that contained no elements heavier than helium. Would you believe her? Why?

An O type main sequence star must have formed in just the past few million years because they're main sequence lifetime is no more than a few million years (O stars have large surface temperatures and very high luminosities and thus burn their hydrogen fuel very quickly). Since our Galaxy is 10 billion years old, many generations of stars must have completed their evolution and ejected heavy elements into the interstellar medium before the O star formed, it is **very unlikely that the O star would have formed from pure hydrogen and helium**. Today, it is impossible that there is any pristine cloud of material leftover from the big bang from which new stars can form. Thus the most recent generations of stars must have a substantial amount of matter that has been recycled from the death of an earlier generation of stars. Of course, this matter contains the "metals" that were produced in the interiors of earlier generations of massive stars.

Chapter 14

12. Would you be more likely to observe a Type II supernova (the explosion of a massive star) in a globular cluster or in an open cluster? Why?

A Type II supernova is thought to be produced when a massive star explodes. Since massive stars in globular clusters completed their evolution a long time ago (massive stars only live for approximately a million years while globular clusters are extremely old and have ages of about 10 billion years), **we would not expect to see a Type II supernova in a globular cluster** today. One might occur in a very young (open) cluster, where very massive stars might just be completing their life cycle.

13. Astronomers believe there are something like 100 million neutron stars in the galaxy. Yet we have found only about 1000 pulsars in the Milky Way. Give several reasons why these numbers are so different. Explain each reason.

Only some of the supernovae that occur in our galaxy are observable. Type II supernovae (explosion of massive stars) tend to occur in the disk of the Milky Way, and **they may be hidden by intervening dust and gas if they are located in most distant parts of the galaxy**. Also, in order for us to see a pulsar **the beam of radio radiation being emitted by the pulsar must be pointed along our line of sight**. Thus, even though the pulsar exists, we may not be able to detect it. Another reason is that **the intensity of radio radiation from pulsars decreases significantly as the pulsar ages** (the magnetic field needed to produce the radiation tends to decay quickly). Eventually the pulsar becomes nothing more than a rotating neutron star.