THE SUN
Chapter 18

INTRODUCTION The Sun is the closest star to the Earth. As important as the Sun is to our existence on Earth, the Sun is a surprisingly unremarkable star. It is average in size, surface temperature, chemical composition, and luminosity. Also, for a star so close, there are still aspects of the Sun that are not well-understood. For example, the exact power-plant in the Sun's cores is thought to be the proton-proton (P-P) chain reaction but there are also side-reactions which also produce energy. Up until recently the P-P reaction was in question because of the "solar neutrino problem", a long-standing problem only recently solved. The Sun is divided into several different somewhat distinct sections, each with their own properties and characteristics. The Sun also undergoes cyclic changes over periods of many years. One notable cycle is the 22-year solar magnetic cycle which is accompanied by the well-established 11-year sunspot cycle. Concomitant with the solar magnetic cycle are coronal mass ejections which blast high energy charged particles into the solar wind and into interplanetary space. A relatively detailed but theoretical picture of the evolutionary history of the creation of the Sun describes the origin and history, as well as the future, of the Sun.

GOALS

- ✓ It is important to know the different characteristics and properties of each of the layers of the Sun.
- ✓ Sunspots and their origin was discussed in some detail. Understanding the origin, cyclic nature, and significance of sunspots (both on the Sun and on Earth) is important. Also, coronal mass ejection events are associated with the cyclic nature of the Sun. These aspects of the Sun should be understood.
- ✓ In the observation lab we looked at both sunspots and prominences produced by the strong magnetic fields associated with sunspots.
- ✓ As a complete understanding of the solar power-plant, we discussed, in some detail, nuclear reactions and nuclear chemistry. Writing nuclear reactions correctly is essential to fully understanding the thermonuclear fusion reactions which take place in the core of stars.
- ✓ The proton-proton chain reaction is the thermonuclear fusion reaction thought to power our star. Triple-alpha fusion is the reaction that will power our Sun when it enters its red giant stage. Knowing these reactions and their energetic characteristics is valuable.
- ✓ Until recently, there was a problem with the P-P chain: the "Solar Neutrino Problem". You should know what this problem is and how it was resolved.

DEFINITIONS

You should have a working knowledge of at least these terms and any others used in lecture and lab. Many of. these terms will be found In the glossary at the class website.

core
radiative zone
convective zone
photosphere
chromosphere
corona
granule
spicule
solar wind
coronal mass ejection
magnetic field
sunspot
penumbra
umbra
coronal hole
11-year solar cycle
22-year solar cycle
equilibrium
filament
plage
prominence
flare
limb darkening
fission
fusion
isotope
thermonuclear reaction
mass defect
electron
positron
proton
neutron
γ-ray
neutrino
alpha particle