GRAVITATION AND THE WALTZ OF THE PLANETS

Chapter 4

INTRODUCTION The history of the development of modern scientific thought are discussed in detail in lecture and the textbook. Many of the major contributors are presented as is their achievements and contributions. The one aspect of the historical perspective of the evolution of science that might be most important is that theories are "dynamic"; that is, observations and the results of experiments change little throughout history but the models, theories, and explanations of the observed phenomena are regularly modified, improved, and even discarded. As astronomy matured and the laws of physics were developed and refined, astronomy moved from merely an observational science into a quantitative science where Newton's laws and Kepler's laws (to name only a few) were able to predict the outcomes of experiments and provide insight into the motion of celestial bodies.

GOALS

- ✓ It is important to be able to trace out the history of scientific thought and discovery starting from Plato and coming to the 21st century.
- ✓ As part of a comprehensive understanding of the history of the history and nature of science, it is important to know the people who took part in its evolution. The exact year of every discovery is not nearly as important as the era and the relationship of the discovery to the sociological, political, and technological progress of the time.
- ✓ In this chapter, many new terms are introduced as are the details and diagrams confronting the astronomer and astrophysicist with regards to celestial motion and celestial mechanics. Mastery of the terms and diagrams is necessary for complete mastery of basic astronomy.
- ✓ This chapter presents a significant number of equations relating to Kepler's and Newton's laws. Each of these formulae must be understood both at a level what they physically represent as well as how they are used practically. To help in this understanding, several problems are introduced in lecture and in the text centering on gravitation and celestial mechanics.

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.

acceleration
aphelion
apogee
conic section
conjunction
inferior conjunction
superior conjunction
deferent
eccentric
eccentricity
equant
ellipse
elongation
eastern elongation
greatest eastern elongation
western elongation
greatest western elongation
epicycle
escape velocity
experiment
focus (*pl.* foci)
force
geocentric model
gravitational force
gravity
heliocentric model
homocentric model
hyperbola
hypothesis
inferior conjunction
inferior planet
inverse square law (of gravity)
Kepler's laws
law
major axis
mass
minor axis
Newton's laws
nova
Occam's razor
opposition
orbit
parabola
parallax
perihelion
period (as in a planet)
prograde motion
Ptolemaic system
retrograde motion
semimajor axis
semiminor axis
sidereal period
speed
superior conjunction
superior planet
synodic period
theory
tidal force
universal gravitation constant
velocity
weight