Spring, 2004 **Astronomy 100g: The Universe** Nick Warner

Review for the 1st midterm exam

DISCLAIMER: THESE NOTES SHOULD HELP FOR THE PREPARATION OF THE FIRST MIDTERM EXAM. THEY INDICATE HOW TO DISTINGUISH THE ESSENTIAL FROM THE LESS ESSENTIAL MATERIAL. HOWEVER, THEY ARE NOT MEANT TO BE A COMPLETE LIST OF THE ESSENTIAL MATERIAL. **CAVEAT EMPTOR.**

• 1: Introduction

The first lectures covered introductory ideas concerning: (i) The motivation for astronomy, (ii) truth and certainty in science, (ii) The scientific method, Ockham's razor, and how they are used in forming models of the natural world, (iii) The rudiments of quantitative approach (powers of 10, units of length *etc.*) (iv) Angles, angular size and scales of objects; triangulation and (the basic idea of) parallax.

This is not a training school for boy and girl scouts, and so you do not have to memorize all the constellations and star names. However, you should appreciate what a constellation is, and what star labels like $\alpha, \beta, ...$ mean. This chapter contains a lot of important material that you should understand well.

First there are all the details of how the Earth moves around the Sun, and its consequences for our perception of the sky as seen from the Earth: (i) celestial coordinates (R.A. and Dec.) and the celestial sphere, (ii) Diurnal motion of the sky, (iii) Tilt of the Earth's axis and its consequences for position of the Sun (and Moon) in the sky (iv) Seasons and length of day (v) Precession of the Earth's axis (vi) The measurement of time and astronomy. (e.g. solar and sidereal time, tropical vs sidereal year). You will also need to be familiar with many of the terms used in the chapter, and what they mean: meridian, zenith, vernal and autumnal equinoxes, solstices, celestial sphere, celestial poles, celestial equator, ecliptic, sidereal, precession .... .

Secondly, there are all the details and consequences of the motion of the Moon around the Earth: In particular, (i) phases, their timing and correlation with rising, setting and meridian transit, and (ii) eclipses of all types, how they work, and what you can expect to see.

• 2: The Copernican Revolution

As far as ancient astronomy is concerned, I gave a a major part of a lecture on work of Eudoxus, Aristotle, Aristarchus, Hipparchus, Ptolemy and Eratosthenes. You should have a good idea who did what, and have some idea as to how they figured things out. Again, there is a lot of terminology – roughly speaking, if it is in **bold face** in the text, then you should **know what it means**. You should know the old system, the Ptolemaic model, and understand the evolution of thought that led to the replacement of this model. In particular, you should know how planetary motion is described in the old and new systems. Copernicus: what he achieved and what he did not. You should also have some idea of the contributions from the Middle East. Brahe's observations and Kepler's three laws (very important!). How Physics entered the game, and most particularly the work of Galileo and Newton. You need to know what velocity and acceleration are, and know in what circumstances acceleration is non-zero. I will not expect you to be able apply Newton's laws at a *highly mathematical* level. On the other hand I will expect you to understand roughly what each says and how it gives a deeper understanding of descriptive laws of motion like Kepler's.

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You should also have an intuitive grasp of Kepler's and Newton's laws and understand the consequences of varying various quantities (*e.g.* doubling masses in Newtons laws of motion and in his law of gravity).

• 3: Radiation: Introductory material

Essentially sections 5.1 – 5.2 of the text book. What waves are, and the meaning of frequency, period and wavelength - and how they are related to wave speed. Diffraction and interference, and the effects of wavelength and aperture size on diffraction. The speed of light and how it was determined. The nature of electromagnetic waves: the spectrum, light as a wave. You should know the names of the various kinds of electromagnetic radiation, and be able to order them according to wavelength, and you should know the approximate wavelength of visible light. You should also know about the contributions of Rømer, Young, Maxwell and Newton.

• General Comments

While reading the chapters is important, my primary guide in *setting* the exam will be the lectures and the homework. The exam will have sixty multiple-choice questions and my goal (not always achieved) is to have between five and ten questions taken from the material presented in each lecture (and there are eight lectures covered by the exam), with particular emphasis on material covered in the homework.