

Astronomy 45 - Fall 2001
Introduction to Astrophysics
Table of Contents

1. Introduction to Astrophysics

- 1.1 Introduction
- 1.2 Planets
 - 1.2.1 Geometry
 - 1.2.2 Parallax
 - 1.2.3 Transit of Venus
 - 1.2.4 Luminosity
 - 1.2.5 Circular Motion

2. The Astronomical Context

- 2.1 Angles and Positions
 - 2.1.1 Coordinate systems in the sky
 - 2.1.2. Angular separations
 - 2.1.3 Solid angle
- 2.2 Brightness Measurements
 - 2.2.1 Flux and UBV system
 - 2.2.2 Apparent magnitudes
 - 2.2.3 Absolute magnitude
 - 2.2.4 Spectra
- 2.3 Velocity measurements
 - 2.3.1 Proper Motion
- 2.4 Distance Measurements

3. Radiation

- 3.1 Photons
- 3.2 The specific intensity
 - 3.2.1 Flux
- 3.3 Energy Density
- 3.4 Radiation Pressure
- 3.5 Flux from a sphere of uniform brightness
 - 3.5.1 Thermal Radiation
 - 3.5.2 High and low T limits
- 3.6 Stefan-Boltzmann Law
 - 3.6.1 Einstein A and B coefficients
- 3.7 Radiation balance
 - 3.7.1 Temperatures of the planetary surfaces
- 3.8 Spectral Sequence of Stars
- 3.9 Other Radiation Mechanisms
 - 3.9.1 Synchrotron and cyclotron radiation
 - 3.9.2 Bremsstrahlung
- 3.10 Telescopes

4. Classical Dynamics

- 4.1 Newtonian Gravity
 - 4.1.1 Newton's laws
 - 4.1.2 Gravitational potential
 - 4.1.3 Gravitational attraction of a spherical shell
 - 4.1.4 Solid sphere
 - 4.1.5 Two solid spherical bodies
- 4.2 The Two-body Problem
 - 4.2.1 Two-body orbits
 - 4.2.2 Runge-Lenz vector
 - 4.2.3 Orbits
 - 4.2.4 Mass of sun
 - 4.2.5 Interplanetary travel
 - 4.2.6 Moment of inertia of a spinning sphere
 - 4.2.7 Total Angular Momentum of the Jupiter-Sun System
- 4.3 Binary Stars
- 4.4 Extrasolar Planets
- 4.5 Supernovae in binary systems
- 4.6 Tides
 - 4.6.1 Weak tides
 - 4.6.2 Tidal friction
- 4.7 Roche stability limits for satellites
- 4.8 Roche lobes
 - 4.8.1 Effect of mass transfer on binary orbits
- 4.9 The Virial Theorem
- 4.10 Gravitational Collapse

5. Stars and Stellar Structure

- 5.1 Phenomenology
 - 5.1.1 Element Abundances
 - 5.1.2 Nuclear reactions
 - 5.1.3 Collapse of a Massive Star - Type II supernova
- 5.2 Stellar Structure
 - 5.2.1 Order of magnitude
 - 5.2.2 Stellar interiors
 - 5.2.3 Equations of stellar structure
- 5.3 Equation of State
- 5.4 The Perfect (Ideal) Gas Law
 - 5.4.1 Adiabatic index
 - 5.4.2 Convection
 - 5.4.3 Equation of State for Degenerate Matter
 - 5.4.4 White Dwarf Stars
 - 5.4.5 Neutron Stars
 - 5.4.6 Black Holes
 - 5.4.7 Stellar Structure Virial Theorems

6. Cosmology

- 6.1 Cosmological Principle
- 6.2 Cosmic Microwave Background
- 6.3 Expansion of the Universe
 - 6.3.1 Age Of Universe
- 6.4 Newtonian Dynamics
 - 6.4.1 Critical Density
- 6.5 Flatness Problem
- 6.6 Einstein-deSitter Universe
 - 6.6.1 Relativistic Matter (Radiation)
 - 6.6.2 Matter-dominated Einstein-deSitter Universe
 - 6.6.3 Radiation-Dominated Einstein-deSitter Universe
 - 6.6.4 Red Shift Universe
- 6.7 Cosmological Constant
- 6.8 History Of The Early Universe — Recombination

7. Interstellar Medium

- 7.1 Nebulae
- 7.2 Interstellar Gas and Dust
 - 7.2.1 Phases
 - 7.2.2 Hot gas