**Study Guide for Final Exam. Astronomy & Astrophysics I**

Angular Resolution of the Eye and Telescopes

 Dependence on Diffraction theory

 Astronomical “Seeing”

 S/N in astronomical detectors

Blackbody Radiation from Stars

 Wien’s Law

 Stefan-Boltzmann Law

 Color Temperature, Flux and Luminosity

Parallax and Distance

Magnitude, Absolute Magnitude, Color Index

Spectral Type

Stellar surface Temperature

Absorption Lines (conditions of formation)

Quantum mechanical description of stellar atmospheres

 Boltzmann Eqn

 Saha Equation

Line Profiles

 Natural, Pressure, Thermal, Rotational

Binary Stars

 Spectroscopic binaries

 Masses from RV curves

Mass Function

 Sizes from Eclipse duration

Hertzprung-Russell Diagram

 Be able to plot it, with order of magnitude labels

 Know all the major features

 Explain the slope of the main sequence

 Know the timescales for evolution

Estimate the pressure at the center of the Sun

Apply the Virial Theorem to estimate the temperature deep in the Sun

Know the Proton-Proton Chain, CNO Cycle and Triple-Alpha Process

Explain the quantum mechanical and thermodynamic principles that apply to the nuclear reaction rates in a star. (Gamow function, kinetic energy needed to overlap proton wavefunctions, Maxwell distribution)

Stellar Evolution.

Main sequence to red-giant branch, to SN or WD

Know the internal changes (core/shell burning),

Timescales

How the observable properties of stars respond.

Evolutionary tracks on the HR diagram

Supernovae: Types, Physics, Lightcurve, Available energy, Nucleosynthesis, Neutrinos, Relic

Degenerate Matter -> Chandasekhar Limit, (physical outline of the derivation) WD, NS, BH

Properties of WD, NS, BH (Schwarzchild radius –semi-classical derivation)

Observational differences between NS & BH

Pulsars -> Birth Spin, period derivative, spin-up during accretion, angular momentum conservation.

Radiation Pressure and the Eddington Limit

 Derivation using Thompson Cross section

 Application to BH luminosity, NS maximum spin-up, stellar mass upper limit

Initial Mass function -> Relationship to spectral types and elemental abundances

X-ray Binaries