ASTR 504B COURSE OUTLINE
Winter 2012

- ✓ The Sun's exterior

  Basic properties
  Distance, radius, mass, density, surface gravity

  Photosphere – the visible surface of the Sun
  Limb darkening (and limb brightening)
  Granulation
  Differential rotation – outside and in
  Sunspots
  The Sun's magnetic field – Babcock-Leighton model
  Solar activity cycles

  Chromosphere

  Corona and solar wind

  Flux and luminosity – the solar constant

- ✓ Principles of stellar structure

  Starting assumptions and simplifications
  Equations of stellar structure
  Hydrostatic equilibrium
  Dynamical timescale and other timescales
  The Virial Theorem
  Estimating basic internal properties of the Sun
  Radiation pressure
  Energy generation – source of the Sun's luminosity
  Energy transport – How does that energy escape?
    Convection
    Radiation and opacity
  Stellar spectra and absorption lines

Mean molecular weight
Equations of state
Ideal gas law
Kinetic theory of gases
Degenerate gas
Radiation pressure
Making models
Homologous models
Polytropes

- ✓ The Sun's interior (Standard Solar Model)
- ✓ Helioseismology

p- and g-modes
Lamb and Brunt–Väisälä frequencies
Mode trapping and acoustic cutoff
Harmonic oscillations in 3D

2D Fourier transforms – spatial and temporal
Mathematical inversion of the data
Kernels and eigenfunctions

Testing the Standard Solar Model
Internal solar rotation
Time-distance helioseismology

- ✓ Properties of stars
- ✓ Stellar models
- ✓ Stellar pulsation and asteroseismology
- ✓ Star and planet formation
- ✓ Stellar rotation