Ay20 Final Exam Review Alternative Outline

I tried to group concepts covered in this class by relevant physics concepts. The hope is that you'd be scavenger-hunting through different parts of the course and hopefully making some new connections across concepts.

Brightness and Radiative Transfer

- What is brightness F/Ω and what's its unit? Note that this is the same thing as what we call "Intensity" in Lecture 8.
- What is opacity κ and what's its unit?
- Write down the radiative transfer equation with *I* being intensity (aka brightness). What's the solution for absorption only (ref Lecture 6). Can you spot the definitions of optical depth and source function from the radiative transfer equation (ref Lecture 8)?
- Opacity as a source of radiation pressure (Lecture 8) and how the Eddington luminosity is derived
- How does extinction arise and how does the amount of extinction depend on wavelength?

Convection

- Convection happens when you have a very high temperature gradient or a very low pressure gradient (Lecture 9 p7). Where in a sun-like star is convection likely to happen? How about a giant star? (hint C&O p 325)
- Describe the energy transport mechanism from the core to the atmosphere of the sun (ref recitation 2)

Atomic and nuclear physics

- What's the Gamow peak and how does it relate to the conditions under which nuclear burning occurs?
- What determines the type of nuclear fuel a star consume and how is that related to the Gamow peak?
- How do hydrogen lines arise?
- What are the broadening mechanisms for spectral lines? (ref Lecture 13)
- Draw a picture for each of the following source of opacity: Thomson scattering, free-free, bound-free, bound-bound.
- What does the Boltzmann equation/Boltzmann factor say for things in thermodynamic equilibrium? What are its implications for the hydrogen atom? How about for the 21-cm spin flip transition?
- How is the Stromgren sphere defined and what variables are relevant in determining it around a star?

Optics

- How is the resolution of a telescope defined and what does it have to do with the double-slit experiment?

Kinematics

- What are Kepler's Laws? Be careful which reference frame you're in! (Set 1). What information does the mass function of a binary give you?
- Virial theorem as applied to stars and dark matter halos (Lecture 16, Lecture 18)
- How does one measure the dynamical mass of a galaxy and how is it related to dark matter?
- What's the criterion for a molecular gas clump to form stars? Describe the process from gas to a main sequence star.
- Why is dark matter a sphere but the collection of stars a disk?

Miscellaneous

- How is the celestial sphere defined? What are RA, DEC, and epoch?
- Telescope signal-to-noise equation (Set 2)
- Draw a schematic of the Milky Way
- Absolute and apparent magnitude
- Draw the evolution of a sun-like star across the HR diagram, from a proto-star to a white dwarf