Astronomy II - Stars and Galaxies (Astr 1020)
Fall 2013
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REVIEW FOR FIRST EXAM

This review sheet is intended to be a broad guide to help you prepare for the examination. Some of the exam questions will test basic knowledge of the material (i.e., knowing just the facts), but others test understanding of the implications of these facts. So, you will be tested on knowledge and application. This is NOT an exhaustive listing! Material for the 1st exam will not be limited to what appears here, but if it appears here, I consider it to be important. Calculators will be needed. Expect about 30 multiple choice questions with a few being quantitative problems.

Focus your study on my lecture notes and ppts, the homework, and the text ("Astro4U"). If you have any questions, feel free to see me at office hours (walk-in) or arrange an appointment.

1. *Historical*

   - Ptolemy and the geocentric model; Aristarchus, Aristotle, Pythagoras, Eratosthenes
   - Copernicus and the heliocentric model - understand how retrograde loops motivated the heliocentric approach
   - Kepler and his three laws of planetary motion (know about ellipses, and jargon such as "semi-major axis" and "eccentricity")
   - Galileo's contributions to modern astronomy, especially the heliocentric model
   - Hooke - central forces
   - Newton and his three laws of motion; terminology: forces, inertia, speed, velocity, acceleration, momentum, angular momentum ("spinnedness")
   - Kirchoff's three laws - different cases
   - blackbodies - know what these are plus Wien's law and Stefan-Boltzmann law
   - Bohr atom - know about electrons, protons, neutrons, nucleus, energy levels, absorption, emission, ionization, recombination and relation to Kirchoff's laws

2. *Science*

   - scientific notation, order of magnitude, metric prefixes
   - Gravity (know the formula), circular motion under gravity, meaning of escape speed, gravity explains orbital motions of Kepler's laws
   - Planck's Law - photons and photon energy
   - Blackbodies - Wien's law and Stefan-Boltzmann's Law
   - Flux (i.e., the inverse square law of light), luminosity,
   - Doppler shift - connection to motion, use of redshift and blueshift
   - Electromagnetic spectrum – different kinds of light, wavelengths, frequencies, relation between wavelength and frequency and speed of light, also photons and energy of light

- Observing with telescopes - atmospheric "seeing", atmospheric transparency, why put telescopes in space, concept of "resolution" for image detail (angular resolution) and spectral detail (spectral resolution), telescopes as "light buckets" (aperture size)
- Gases, Pressure, Temperature, Density and the Ideal Gas Law; concept of gas as particles in motion, thermal speed of particles

3. *The Sky*

- Order of the planets from the Sun (remember there are 8 now!)
- celestial sphere, terminology
- know what constellations are (no, do not memorize all of the constellations, but understand how stars in space relate to the celestial sphere)
- perspective issues: rotation of Earth and diurnal motion, star trails, revolution of the Earth around the Sun and relation to seasonal constellations, circumpolar stars
- the ecliptic, the tilt of the Earth, reason for seasons

Expressions we have seen - Be familiar with what the equations represent!

Remember, "$\propto$" means "goes like this"

Wave properties of light, $\lambda\nu = c$

Energy property of photons, $E = h\nu$

Doppler shift, $\frac{\Delta\lambda}{\lambda} = \frac{v}{c}$

Kepler's 3rd law for the Solar System, orbital period $P^2 \propto a^3$

Force of gravity, $F_G = GMm/d^2$

Escape speed, $v_{\rm esc} = \sqrt{2GM/R}$

Circular orbital speed, $v_{\rm c} = \sqrt{GM/R}$

Newton's version of Kepler's 3rd Law, $a^3 = \frac{G(m_1+m_2)}{4\pi^2}\,P^2$

Newton's 2nd law, force $F = ma$

Ideal gas law, pressure $P \propto \rho T$

Thermal speed of gas particles $v_{\rm th} \propto \sqrt{T/m}$

Flux of light, flux $F \propto L/d^2$

Wien's law, $\lambda_{\rm max} \propto 1/T$

Stefan-Boltzmann law, surface brightness $F_{\rm BB} \propto T^4$