Lecture 15

Review

- Midterm Exam Notes
- Review of the Lectures – Key Points

Midterm Exam Notes

The Midterm Exam will be held in CSS2400 (where the lectures are) on

Tuesday, March 28 from 2:00-3:15PM

You must bring with you a **picture ID** (e.g., UID, drivers license)

You are allowed to bring:

- one single-sided letter-sized piece of paper with your own notes. You can write down equations, text, diagrams, etc, but not full solutions to HWs or other exams. Minimum allowed font size is 12PT, or regular sized handwriting.
- pocket calculator (graphic/non-graphic)
- pen(s)

You are **not** allowed to bring:

- any other means, such as cell phones, PDAs, laptop, books, lecture notes, etc.

Midterm Exam Notes - *continued*

Make sure that your **NAME** and **UID** are clearly visible on each page of the Midterm Exam.

If you want/need to leave the exam early you are free to do so, but please leave quietly not to disturb the others.

The Midterm Exam will be similar to the HWs, which means that there will be a number of questions (no multiple-choice) which you have to answer. In your answers you will need to demonstrate that you understood the course material and that you are able to translate physical problems into equations. Equations need to be solved, so don't just give the result.

Relevant for the exam are the

- **lecture notes** (1–15),
- **course book** (1–11), and
- **HWs** (1–5).

Midterm Exam Notes - *continued*

Code of Academic Integrity:

The University is an academic community based on **trust** and **reputation**. Do not violate the trust by cheating.

Cheating will be punished and can lead to the expulsion from class. Unauthorized assistance will not be accepted.

You must adhere to the
Code of Academic Integrity posted here:

http://www.studenthonorcouncil.umd.edu/code.html

Review of the Lectures – Key Points

- **Lecture 2 – Early Cosmology**
  Historical concepts, vacuum, retrograde motions of planets, epicycles, deferent, Copernican revolution, Newton's law of motion, concept of vacuum.

- **Lecture 3 - Stars**
  The electro-magnetic spectrum, energy of photons, frequency & wavelength, wave-particle duality of photons, importance of studying the Universe in all wavelengths, evolution of stars, HR diagram, P-L relationship of Cepheid stars, formation of stars, Tunnel effect, PP-chain, CNO cycle

Review of the Lectures – Key Points

- **Lecture 4 – Stellar Endpoints**
  Onion-shell structure of stars, late stellar evolution, core-collapse, SN explosions, creation of compact objects, White Dwarfs, Neutron stars, Black holes, degeneracy of electrons and neutrons

- **Lecture 5 – Normal Galaxies**
  The Milky Way, spiral arms, disk, bulge, halo, differential rotation of galaxies, spiral arms as traffic jams (density waves), the Hubble 'tuning fork' diagram, types of galaxies

- **Lecture 6 – Active Galaxies**
  Activity in galaxies, AGN, radio/x-ray jets, starburst activity, synchrotron radiation, Compton scattering, Bremsstrahlung radiation, nuclear variability, evidence for black holes at center of galaxies

Review of the Lectures – Key Points

- **Lecture 7 – Distance Ladder**
  The cosmic distance ladder, parallaxes, trigonometry, Cepheids, main-sequence fitting, Type Ia supernovae, Tully-Fisher relationship

- **Lecture 8 – Cosmological Ideas**
  Cosmological ideas, departure from geocentric views, Cosmological Principle, isotropy & homogeneity, Anthropic Principles

- **Lecture 9 – Space & Time**
  Space-time diagrams, the arrow of time, Euclidean and non-Euclidean geometries, curved space

Review of the Lectures – Key Points

- **Lecture 10 – Special Relativity**
  Special Relativity, space & time continuum, postulates of Special Relativity, laws of physics & speed of light as universal, light-cones, simultaneity, time dilation, space contraction, Lorentz factor, twin paradox, velocity addition

- **Lecture 11 – General Relativity**
  General Relativity, Principle of Equivalence (e.g., free-falling elevator), curvature of space, tests of General Relativity, precession of Mercury's orbit, gravitational redshifts, light bending

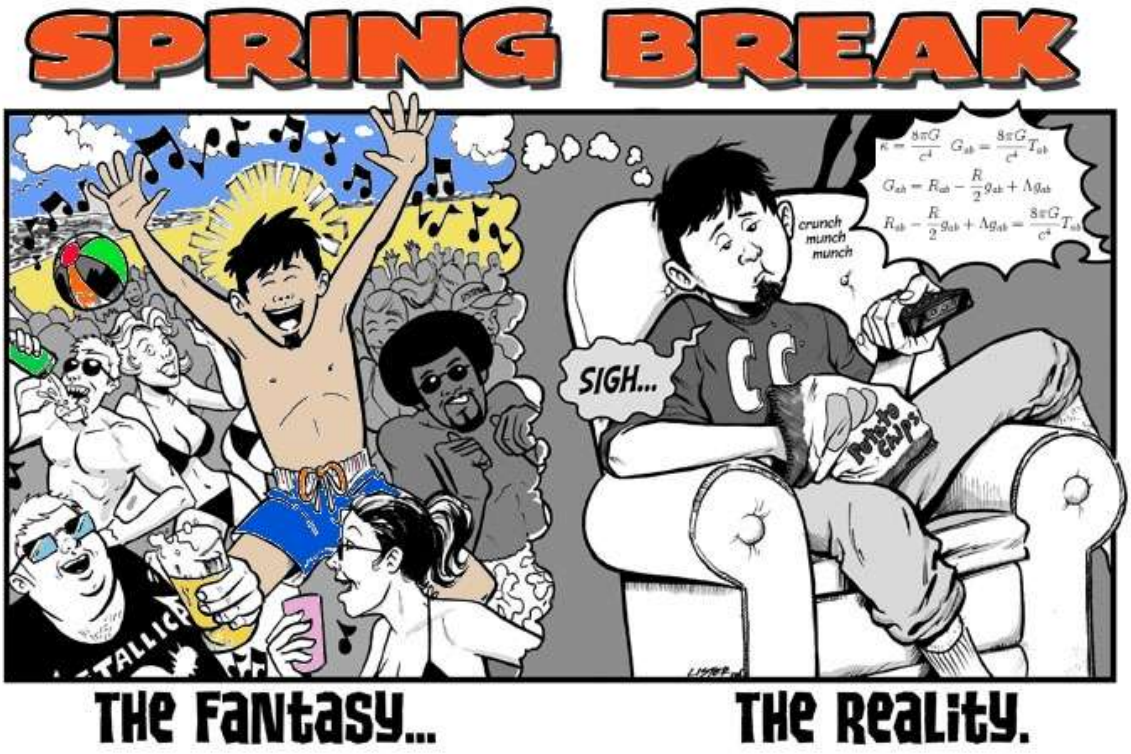
- **Lecture 12 – Black Holes**
  Black holes, escape velocity, Schwarzschild radius, warped space-time continuum, event horizon, rotating black holes (Kerr BHs), frame dragging, observational evidence for BHs

Review of the Lectures – Key Points

- **Lecture 13 – Expansion**
  Expansion of the Universe, Doppler effect, velocity-distance law (Hubble law), discovery of the expansion of the Universe, Hubble constant, Hubble time, acceleration & deceleration in the Universe

- **Lecture 14 – Redshifts**
  Redshifts, Doppler redshift, expansion redshift, gravitational redshift, redshift laws

Have a great Spring Break!



And come back safely!