Today’s class

- Introductions!
- Course logistics
- What is Cosmology?
- Course structure
- The Cosmological Principles
Grading scheme

- **Distribution**
  - HW: 30%
  - Midterm: 20%
  - Project: 20%
  - Final: 30%

- **Letter grade**
  - 90%+: A
  - 80-90%: B
  - 70-80%: C
  - 60-70%: D
  - <60%: F

Absences, academic honesty

- Follow University policy...
- Regular “one-off” absences
  - Please make all reasonable effort to contact me beforehand
  - If absence leads to a missed homework deadline, please provide documentation (self-signed note ok).
- Absence from an exam
  - Midterm and final exam are “major scheduled grading event”
  - Absence must be documented (self-signed note NOT ok)... must also make all reasonable attempts to contact me before the exam
- Academic dishonesty
  - Zero-tolerance policy
  - Absolutely no copying of homeworks or exams!
  - Must list all references used to complete an assignment
II : What is Cosmology?
III : Basic course structure...

- Course develops the Hot Big Bang Theory
- Course structure...
  - The Cosmological Principle
  - Cosmological models and the Big Bang (5 classes)
  - Inventory of the Universe: the need for Dark Matter and Dark Energy (6 classes)
  - Hot Big Bang Theory (4 classes)
  - Formation of structure (4 classes)
  - Inflationary cosmology (2-3 classes)
  - Wrap up
  - + Special Topics classes
IV : The Cosmological Principle

- Early history of cosmology is largely the realization that we do not occupy a special place in the Universe...
  - Once though that Earth was at center of solar system... now we know we’re not.
  - Once thought that Solar System was at center of the Galaxy... now we know we’re not.
  - Once thought that our Galaxy was the dominant structure in the Universe... now we know that it’s a pretty typical galaxy
- Definition: The Cosmological Principle (or Copernican Principle) states that the Universe looks the same where-ever you are and which-ever direction you look

- Two immediate consequences of the Cosmological Principle...
  - Universe is homogeneous: every place in the universe has the same conditions as every other place, on average.
  - Universe is isotropic: there is no preferred direction in the universe, on average.

- Questions (discussion in class):
  - Is it possible to have a space which is homogeneous but not isotropic?
  - Is it possible to have a space which is isotropic but not homogeneous?
Why do we need the Cosmological Principle?
- In detail, Universe is an incredibly complex place... would be impossible to analyze mathematically if there were no simplifying principle
- Assumption of homogeneity and isotropy gives us the simplification that we need
- Cosmology involves using the machinery of General Relativity to model our Universe

Of course, we would be foolish to use CP if it wasn’t actually suggested by data!!
- Evidence for homogeneity and isotropy comes from galaxy surveys, observations of Cosmic Microwave Background, uniformity of elemental abundances...

Sloan Digital Sky Survey

Galaxies color coded by the age of their stars
http://www.sdss.org
Almost uniform intensity of microwaves in all directions (isotropic 2.7K black body radiation)

\[ T = 2.728 \text{ K} \]

Subtracting off the mean level leaves a “dipole” pattern... motion of Earth wrt “cosmological rest frame”

\[ \Delta T = 3.353 \text{ mK} \]