ASTR 1020
Introductory Astronomy 2:
Stars & Galaxies
January 16, 2008

Professor Jack Burns

Newcomers - All class info is at website:
http://solo.colorado.edu/~jaburns/Astr1020SP08/index.html

Notes from last class are now posted on the class website.

Astronomy
Picture of the Day
Trifid Pillars & Jets
Credit: J. Hester (Arizona St. U) et al., HST, NASA

MasteringAstronomy

- All homework will be assigned via the online system MasteringAstronomy.
- Stay up with class assignments in conjunction with the reading.
- The course ID for Astr 1020 in MasteringAstronomy is ASTR1020SP08

Homework

- Reading:
  - Chapter 1.
  - Summary of Key Concepts, p. 21-22.
- Intro to MasteringAstronomy (complete by Jan. 21). Located at website: http://www.masteringastronomy.com
- Your grade will be based on completion of the tutorial and exercises.
- Grades are tracked automatically online. Nothing to hand in!!!
- Start this exercise now in case of technical problems.
- Register your clickers!

Free Planetarium Show

- Colorado Skies: Messenger & Mercury with Ms. Addie Dove.
- Thursday, January 17th at 8:00 pm.
- Fiske Planetarium.
- 1 extra credit bonus point on final grade when you attend a show this semester (be sure to sign sheet when you leave).

Today’s Class: Brief Tour of the Universe; Sizes and Scales

Reading: Chapter 1, sections 1.1 and 1.2

- Scales in space
What we’ll be Studying

- Sizes and scales: finding your way through the universe

Review of Gravity & Light

- What are they?
- How do we use them to understand sizes, masses, and composition of stars & galaxies.

The Sun

Stars of every size and color

Stellar Birth and Life

Star death: white dwarfs, neutron stars and black holes
Our Galaxy: The Milky Way

Exploring a universe of galaxies

Galaxy Evolution & Central Engines

Dark Matter, Dark Energy and the Fate of the Universe

The Big Bang

Navigating the Universe: Sizes and Scales

"I don't pretend to understand the Universe. It's a great deal bigger than I am".

- Thomas Carlyle (1795-1881)
Our Cosmic Address

Earth
Sun/Solar System
Milky Way
Galaxy
Local Group
Local Supercluster

Scale models of the Universe

• Scale Sun as a grapefruit (1:10,000,000,000,000)

- On this scale, the nearest stars would be a system formed by a cantaloupe, a small apple and a kiwi fruit, located in Newfoundland, Canada
- There is essentially nothing in between

New Scale for the Galaxy:

• Earth = pin, 15 meters from Sun.
• Mars = pin, 23 meters
• Jupiter = marble, 78 meters
• Pluto = tiny grain, ¼ mile away
• See model near the Planetarium!

Yet Another Scale for Everything Else

• Stars are microscopic located 2mm apart.
• Milky Way galaxy is 22 meters in diameter, contains 100,000,000,000’s (100’s of billions) of stars.

• Galaxies are 10 inch paper plates.
• Milky Way and nearest neighbor (Andromeda) are 5 meters apart.
• Galaxy groups and clusters contain 10’s to 1000’s of galaxies.
• Superclusters 50 meters across (size of buildings in our scale model) are the largest structures we see.
• Observable universe is about size of Boulder county on this scale.

In this image, each dot is an entire galaxy.

This is big stuff- how to grasp astronomical numbers?

• Powers of 10: count the number of zeros behind the digit (review Appendix C in text).
  • 1000 = 1 thousand = 10^3
  • 1,000,000 = 1 million = 10^6
  • 1,000,000,000 = 1 billion = 10^9
  • 10,000,000,000,000,000,000,000 = 10^{22} = approximately the number of stars in the observable universe- more than the grains of sand on all the beaches on Earth.