Astro 301/ Fall 2005

(48310)

Introduction to Astronomy

Instructor: Professor Shardha Jogee

TAs: David Fisher, Donghui Jeong, and Miranda Nordhaus

Lecture 6 + 7: Tu Sep 20, Th Sep 22

Recent and upcoming topics in class

The upcoming topics are the most math-oriented chapters of this entire course, but we will go through them slowly and use plenty of examples in class.

--- The Four Fundamental Forces
- The Force of Gravity and Newton's Universal Law of Gravitation (end of Lec 5)
- Electromagnetic Forces
- Strong and Weak force s

--- Relating Motion to Forces using Newton's Three Laws of Motion
- Mass, speed, velocity, acceleration
- Newton's 1st and 2nd Law
- Applying Newton's 1st and 2nd laws to objects moving along a circular orbit
  --> Centripetal acceleration and centripetal force (end of Lec 7)
  --> Centripetal acceleration of electrons orbiting the nucleus in an atoms
  -->.Centripetal acceleration of planets orbiting about the Sun in Solar system
  --> Centripetal acceleration of stars orbiting the center of a galaxy
- Newton's 3rd law
- Using Newton's 3rd law to understand weight and weightlessness

--- Motion of galaxies on very large scales : Hubble's Law and the Expansion of the Universe

Lecture 6

Announcements

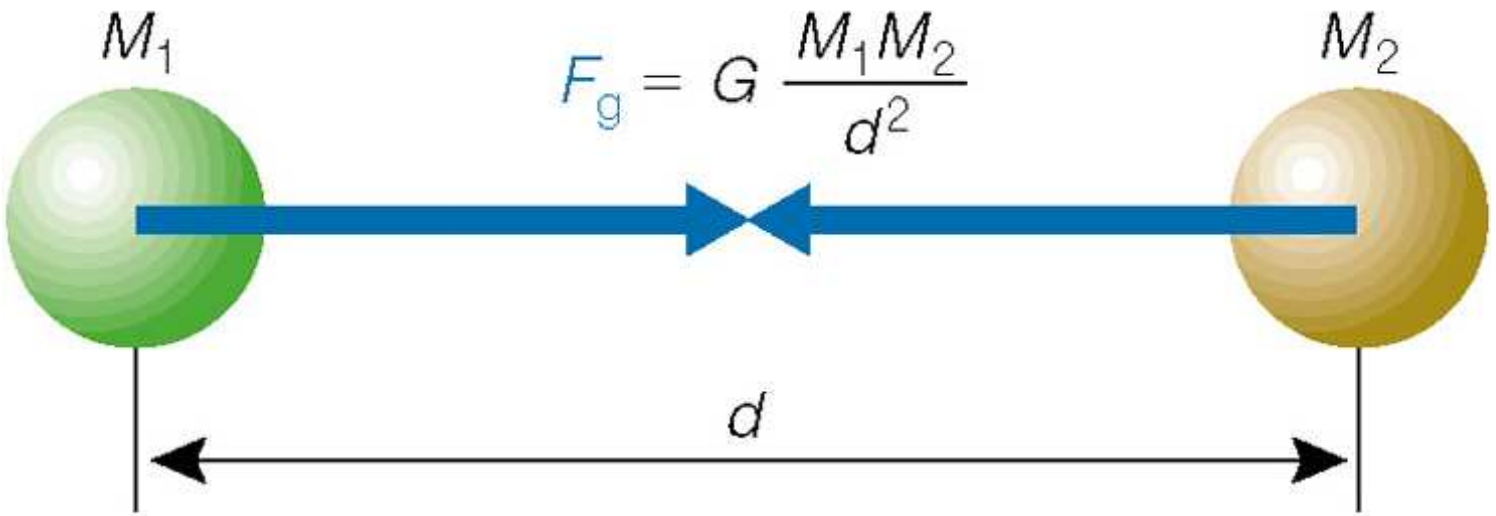
- Hwk 1 due today at start of class.

- ALWAYS CHECK THE CLASS WEBSITE for most current posted notes, announcements, and help sessions

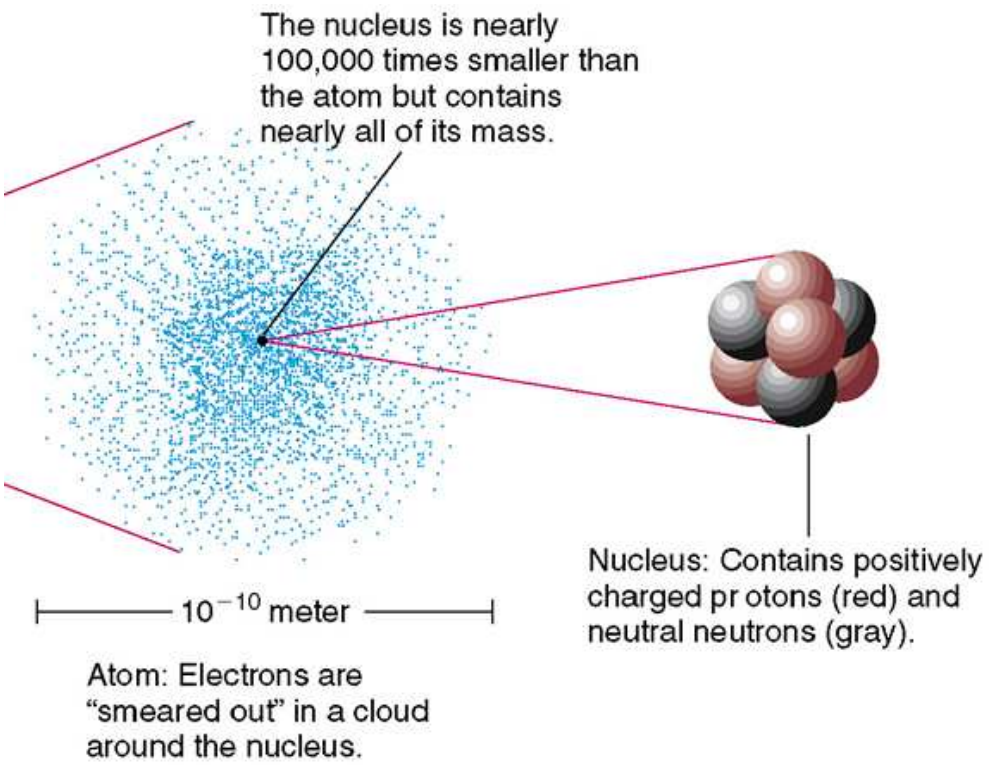
http://www.as.utexas.edu/~sj/a301-fa05/

The Four Fundamental Forces

Newtons' Universal Law of Gravitation



Forces within the nucleus of an atom



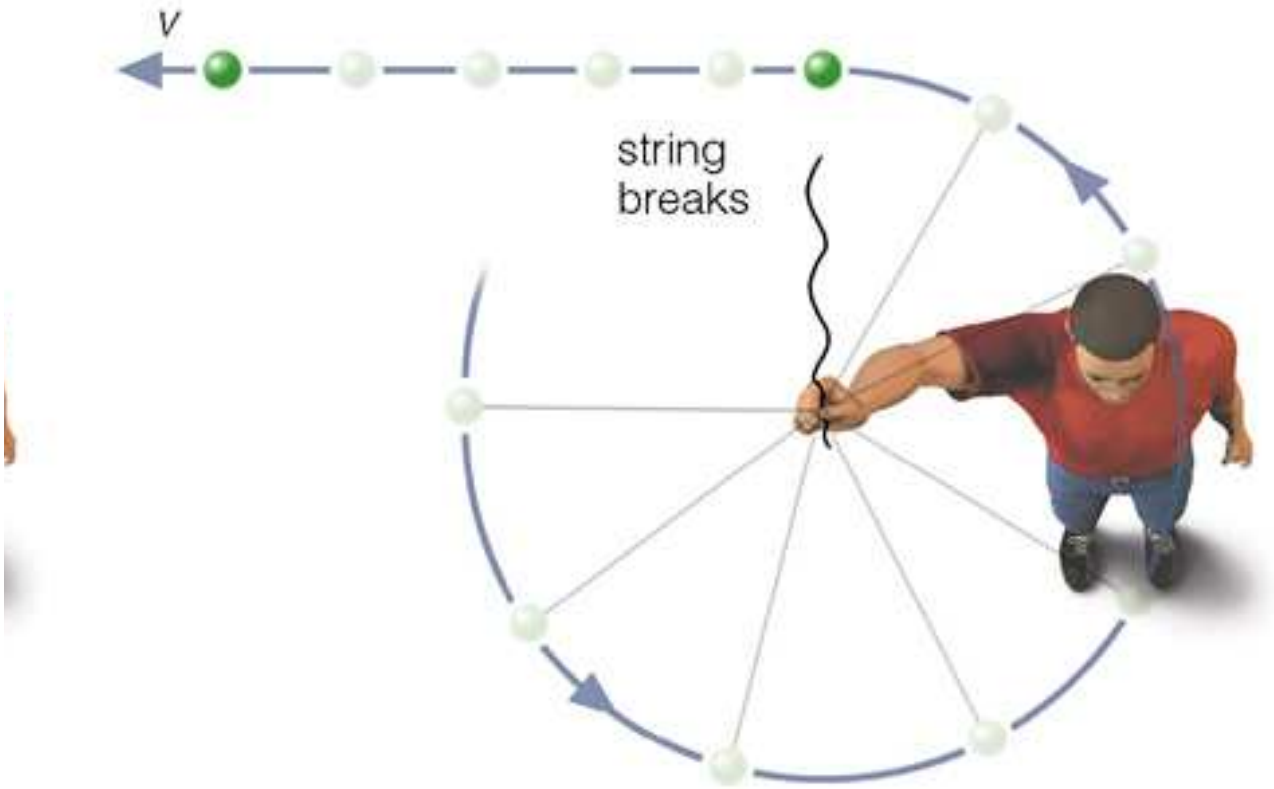
A carbon nucleus
= 6p+ and 6n

A carbon atom s made of 6 e-
orbiting a tiny carbon nucleus

-- See in-class notes: Forces acting are gravity , EM between e- p+
, EM between p+ p+, Strong Forces, Weak Forces

Relating Motion to Forces: Newton's Three Laws of Motion

Speed, Velocity, Acceleration



In class notes

Lecture 7

Announcements

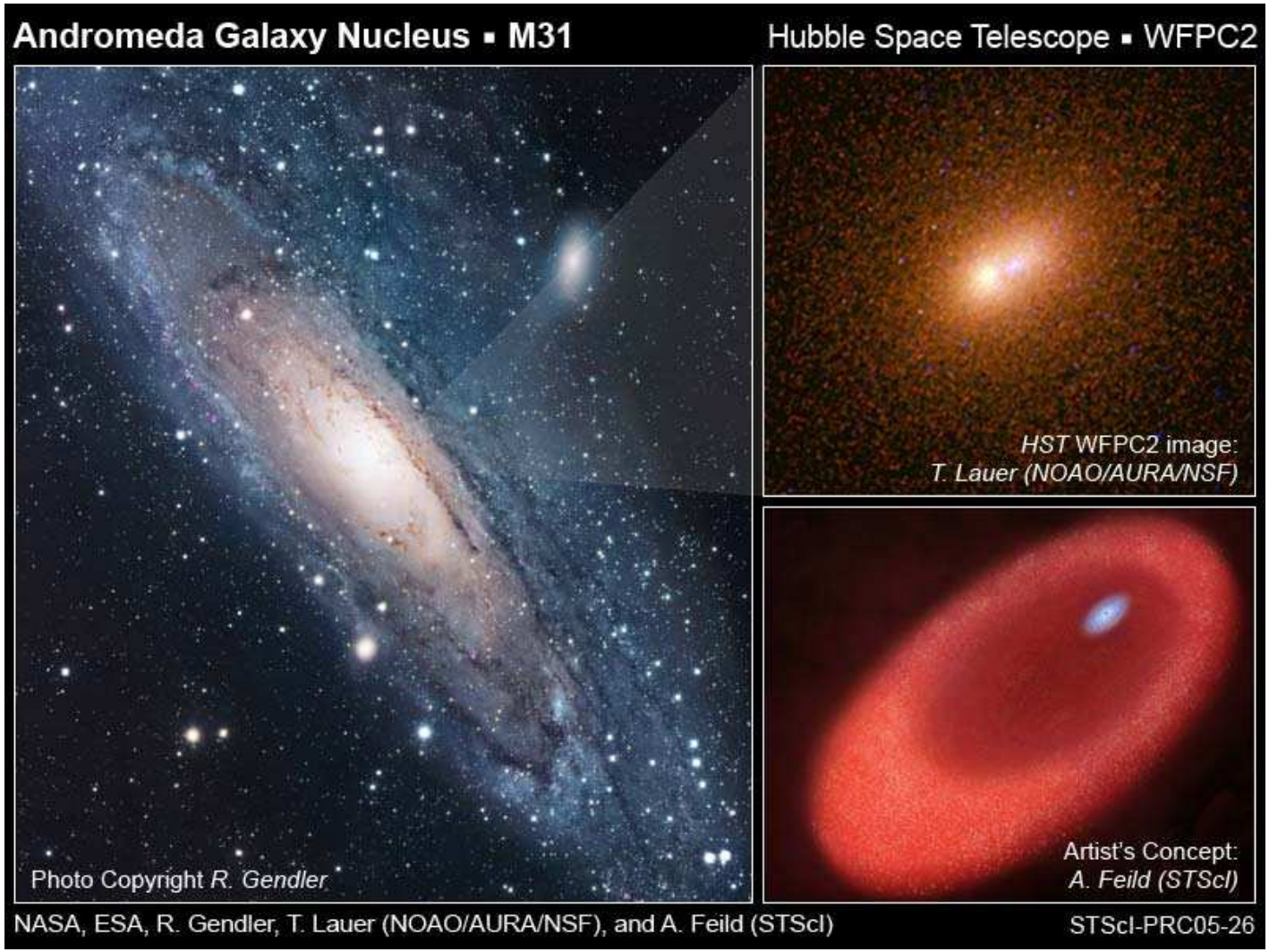
- Quiz 1 back today : 75% A ….well done!

- Quiz 2 on Th Sep 29, based on lectures 4,5,6,7,8

- Homeworks handed after class on due day: 80% credit
  Homeworks handed 1 or more days late: 50% or lower credit

- Class website : http://www.as.utexas.edu/~sj/a301-fa05/

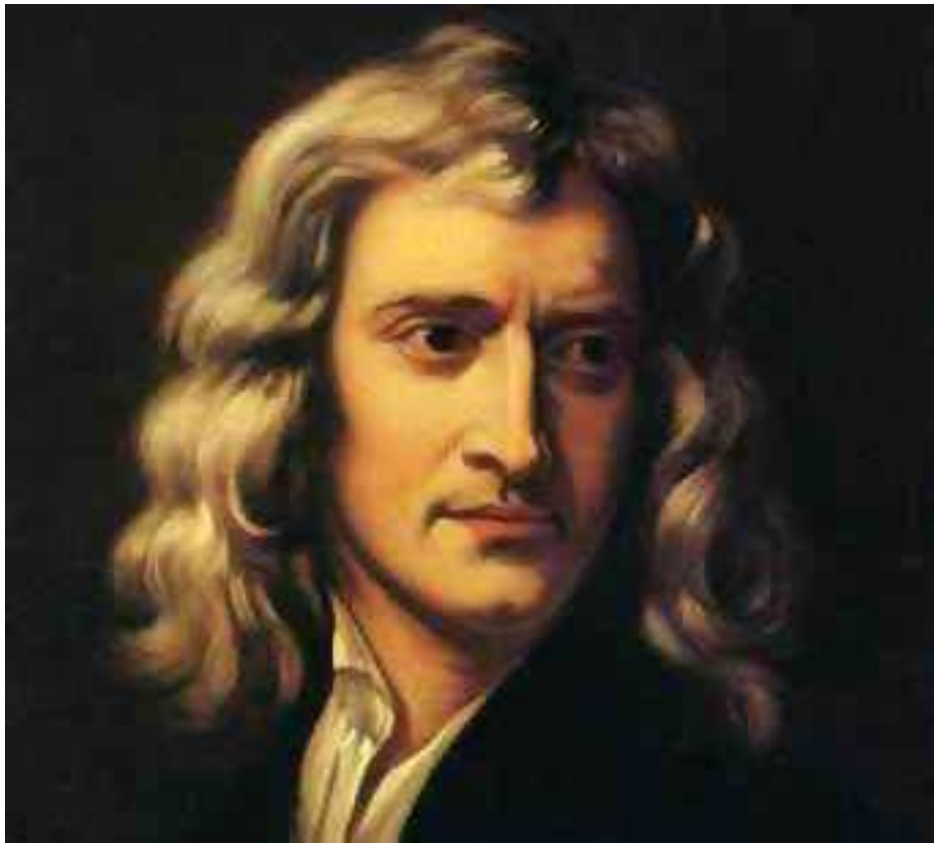
Picture of the day



HST and UT press release this week Sep 2005

Stars close to BH experience tremendous force of gravity and orbit very fast: 1000 kilometers a second…. Would take 40 s to circle the Earth !

Newton's Law of Gravity and Laws of Motion



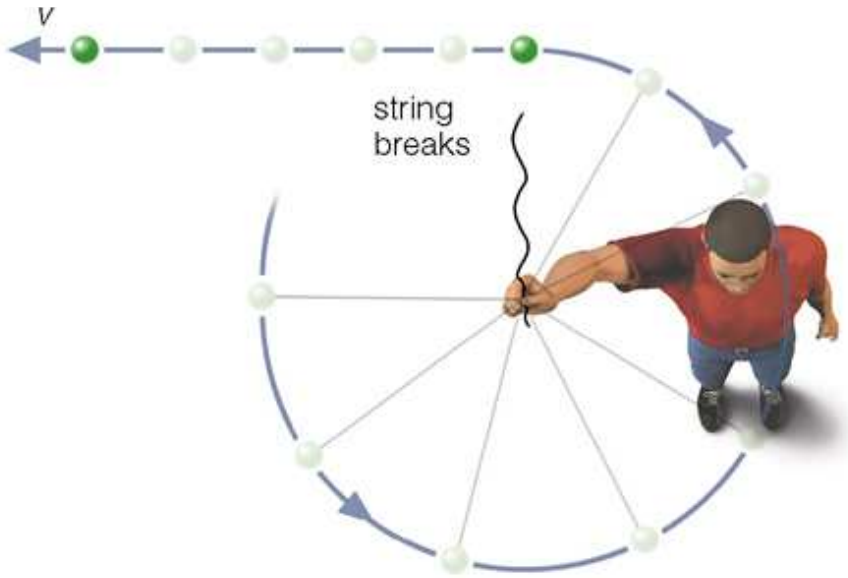
Sir Isaac Newton (1642-1727)
Born in England

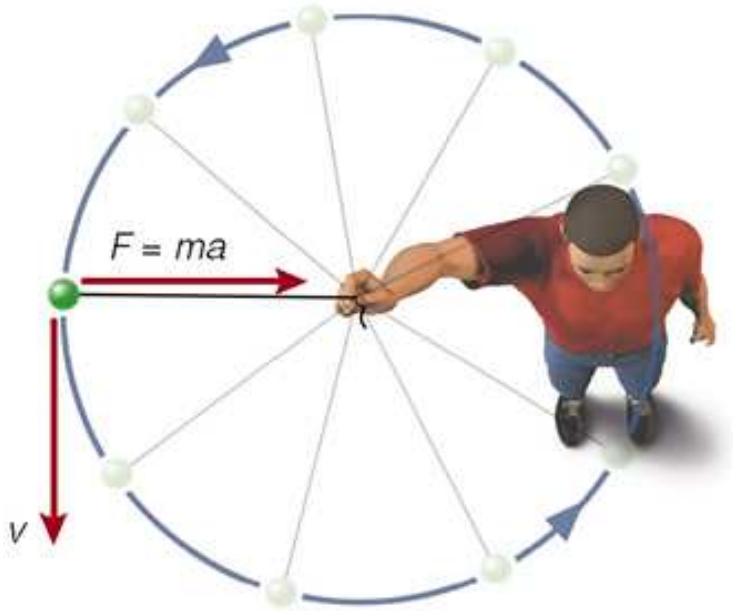
-. Student (1661); Lucasian Professor of Mathematics (1669) at Trinity College, Cambridge Univ
- Unified "the Earth and the Heavens" with his laws of gravity and motion (1665-1666)
- Published "Principia" (Mathematical Principles of Natural Philosophy) in 1687

Newton's 2nd Law of Motion

Force ***F*** = m ***a***

Applying Newton's 1st and 2nd laws to objects moving on a circular orbit: centripetal acceleration





By Newton's 1st law: Without a net force (e.g., if string breaks), the rotating object would move at a **constant velocity** (i.e at constant speed along a straight line).

An object moving in in a circle of radius R at constant speed v experiences

- à a continuously changing velocity
- à an acceleration ***a*** called a centripetal (center-seeking) acceleration

By Newton's 2nd law a force ***F*** **=** M***a*** must act on it to provide this acceleration.

Centripetal acceleration of different orbiting objects

--> Centripetal acceleration of electrons orbiting the nucleus in an atoms
-->.Centripetal acceleration of planets orbiting about the Sun in Solar system
--> Centripetal acceleration of stars orbiting the center of a galaxy
--> Centripetal acceleration of stars orbiting about a central black hole