



Astro 301/ Fall 2006 (50405)



Introduction to Astronomy

<http://www.as.utexas.edu/~sj/a301-fa06>

Instructor: Professor Shardha Jogee

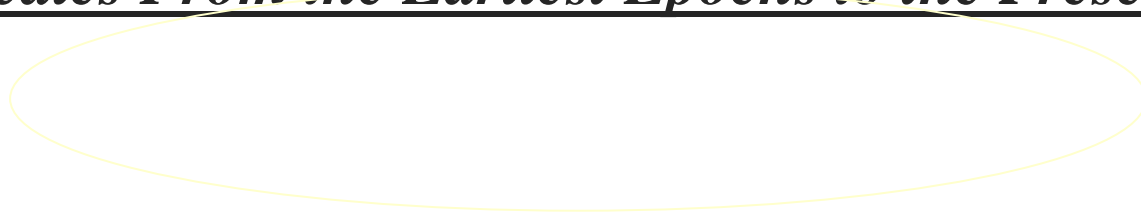
TAs: Biqing For, Candace Gray, Irina Marinova

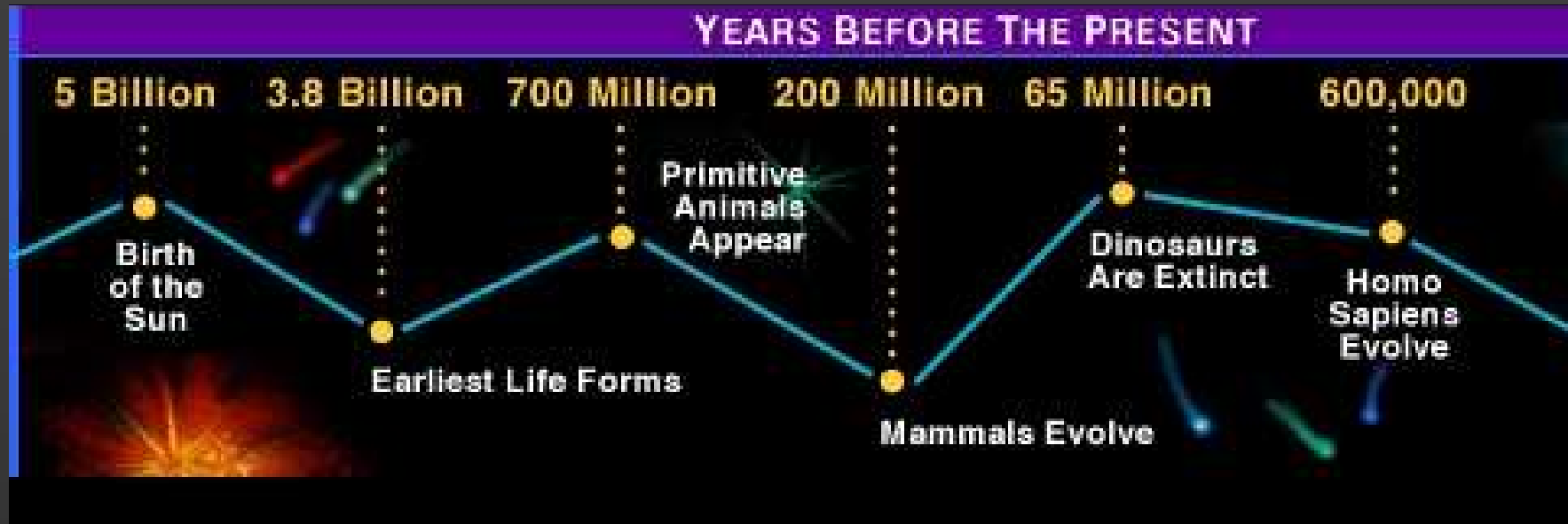
Lecture 6: Tu Sep 19

Recent and Future Topics in class

- Recap: Course Overview and Basic Math Skills
- Natural units in Astronomy
- Overview of Astronomical Objects
 - Building blocks of matter: protons, electron, neutrons, and atoms
 - Stars
 - Brown Dwarfs, Planets, and Moons
 - Death of Stars: Planetary Nebulae, White Dwarfs, Supernovae remnants
 - Why is human life 'star stuff'?
 - Different Type of Nebulae: Star-forming nebulae vs Planetary nebulae
 - Galaxies and the Milky Way
- Scales and Distances: From the infinitesimal to the grandest
- Angular scales and sizes
- Timescales : From the earliest epochs to the present day

Timescales From the Earliest Epochs to the Present Day





See in-class notes

In a mock-calendar where the age of the Universe (13.7 Gyr) is represented by one year, from Jan 1 to Dec 31

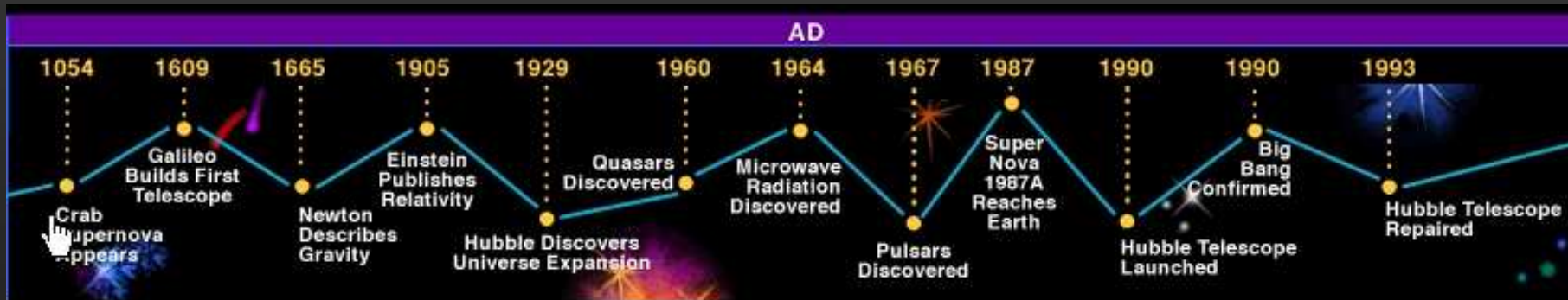
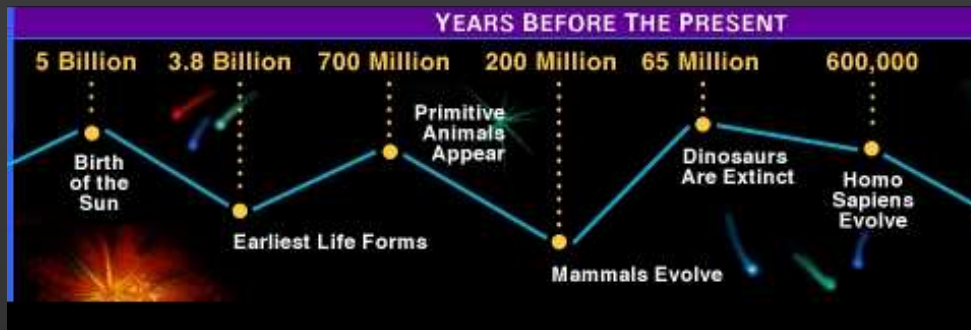
the time where evolved Homo Sapiens appear (600,000 yrs ago) would be in the last 23 min of Dec 31.

the time when agriculture/civilization developed (11,000 yrs ago) would be *in the last 25 seconds of Dec 31. a mere blink of an eye away.*

the epoch of major cultural and scientific development (400 yrs) would be in the last second of Dec 31

The Last 400 years: A Privileged Era

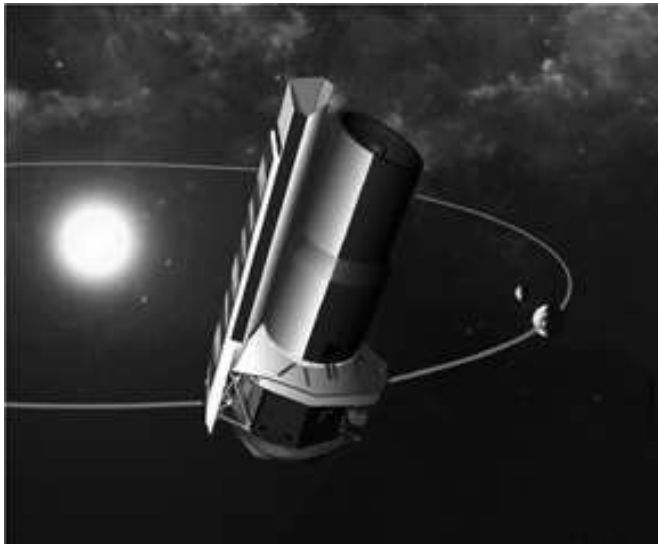
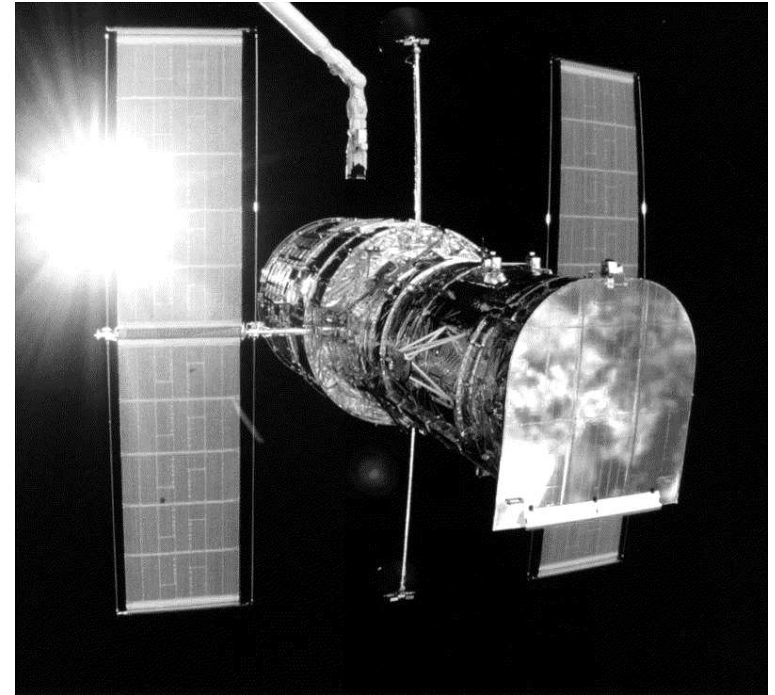
*The last century : tremendous progress in astronomy and astrophysics
à mapping the origin and evolution of the Universe*



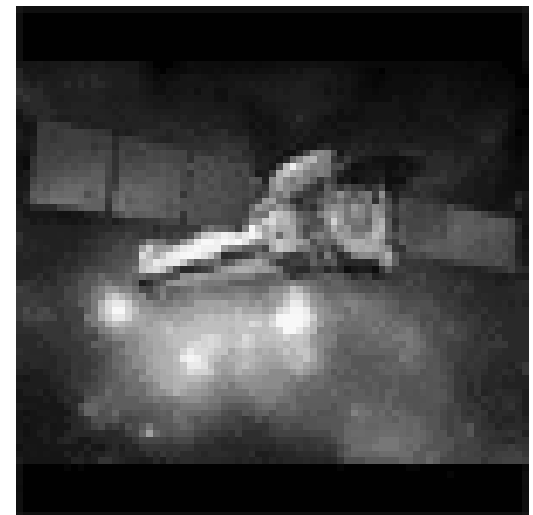
Kepler and Galileo, Newton's law of Gravity; Einstein's theory of relativity, Hubble shows the Universe is expanding; Cosmic Microwave background discovered and COBE launched. Dark matter and dark energy discovered; Hubble and other NASA Great Observatories launched, Cutting edge galaxy surveys to look back in time at the first galaxies

NASA's Three Great Observatories

- Hubble Space Telescope (HST) launched in 1990
Works at ultraviolet, optical and infrared wavelengths
- Chandra X-ray Observatory (CXO) launched in 1999: Works at X-ray wavelengths



Spitzer Space Telescope (SST) launched in 2004 Works at mid to far infrared wavelengths : penetrates the dust

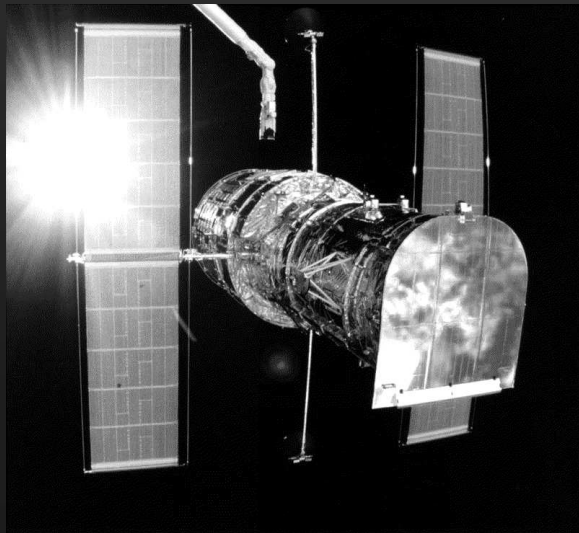


The Hubble Ultra Deep Field (HUDF) Survey in 2004

HUDF is *the deepest visible-light image of the Universe.*

In 2004, the HUDF team proposed the HUDF legacy project and carried the technical planning and observations of the HUDF.

Exposures totaling a million s were taken with the Advanced camera for Surveys (ACS) on the Hubble Space Telescope

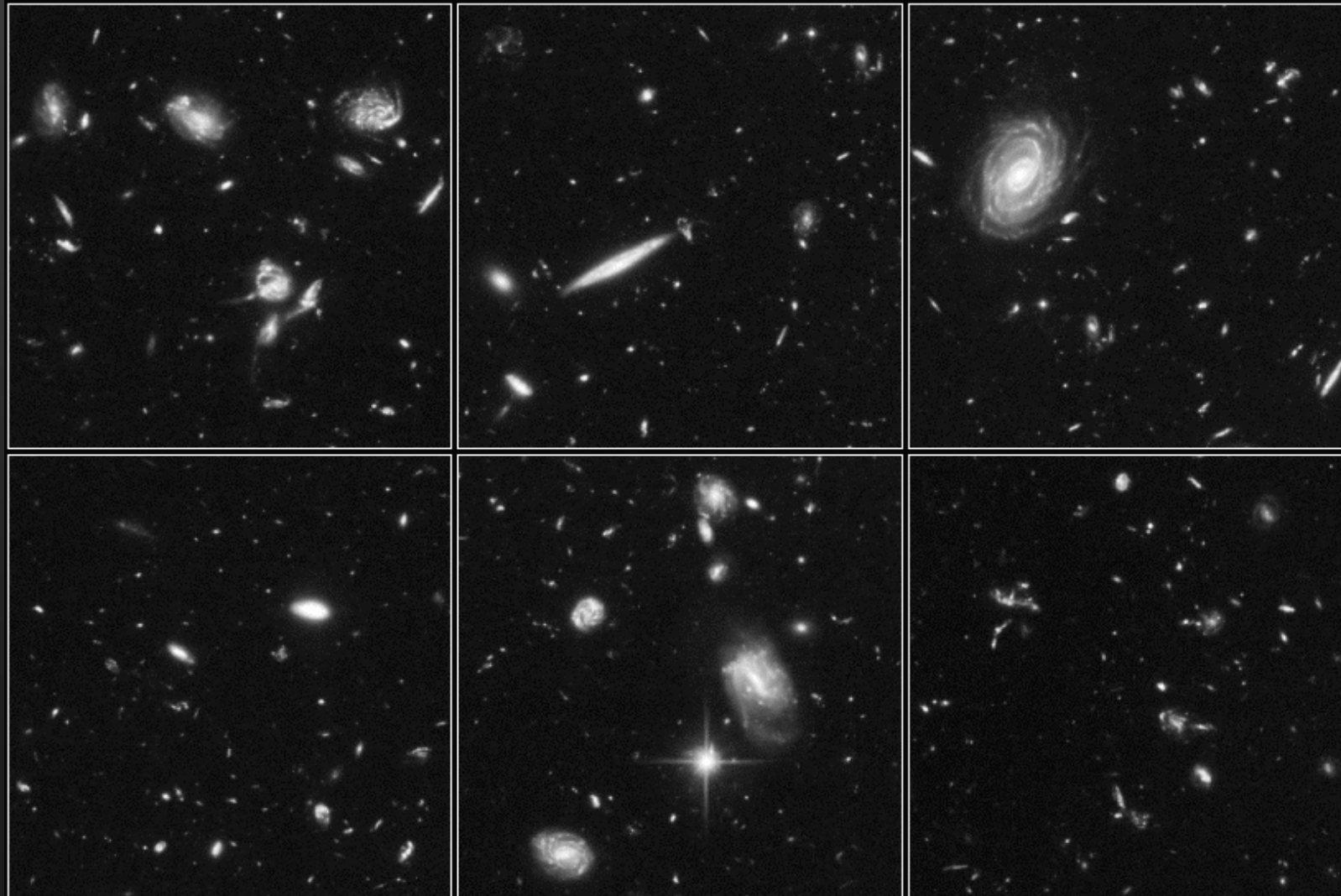


- Steve Beckwith
- John Caldwell
- Mark Clampin
- Michael Corbin
- Mark Dickinson
- Harry Ferguson
- Andy Fruchter
- Richard Hook
- Shardha Jogee
- Anton Koekemoer
- Ray Lucas
- Sangeeta Malhotra
- Mauro Giavalisco
- Nino Panagia
- James Rhoads
- Massimo Stiavelli
- Rachel Somerville
- Stefano Casertano
- Bruce Margon
- Chris Blades
- Massimo Robberto
- Megan Sosey
- Eddie Bergeron

HUDF team

The Hubble Ultra Deep Field (HUDF) Survey in 2004

HUDF allows us to look back about 12 Gyr in time....out to epochs when the Universe was merely 5% of its present age





Astro 301/ Fall 2006 (50405)



Introduction to Astronomy

<http://www.as.utexas.edu/~sj/a301-fa06>

Instructor: Professor Shardha Jogee

TAs: Biqing For, Candace Gray, Irina Marinova

Lecture 7: Th Sep 21

Announcements (Lec 7)

See current Announcements on class website

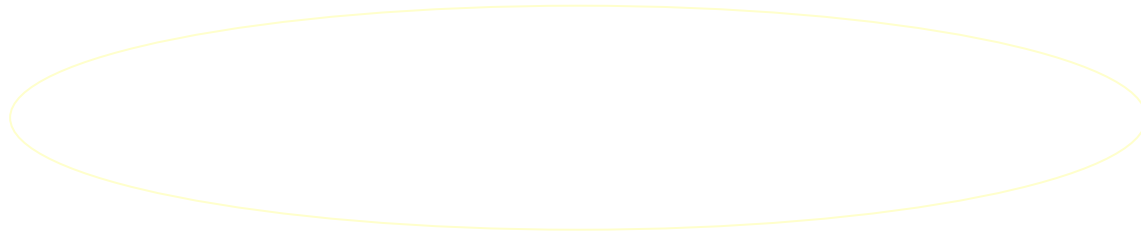
<http://www.as.utexas.edu/~sj/a301-fa06/>

à Hwk1 and quiz 2

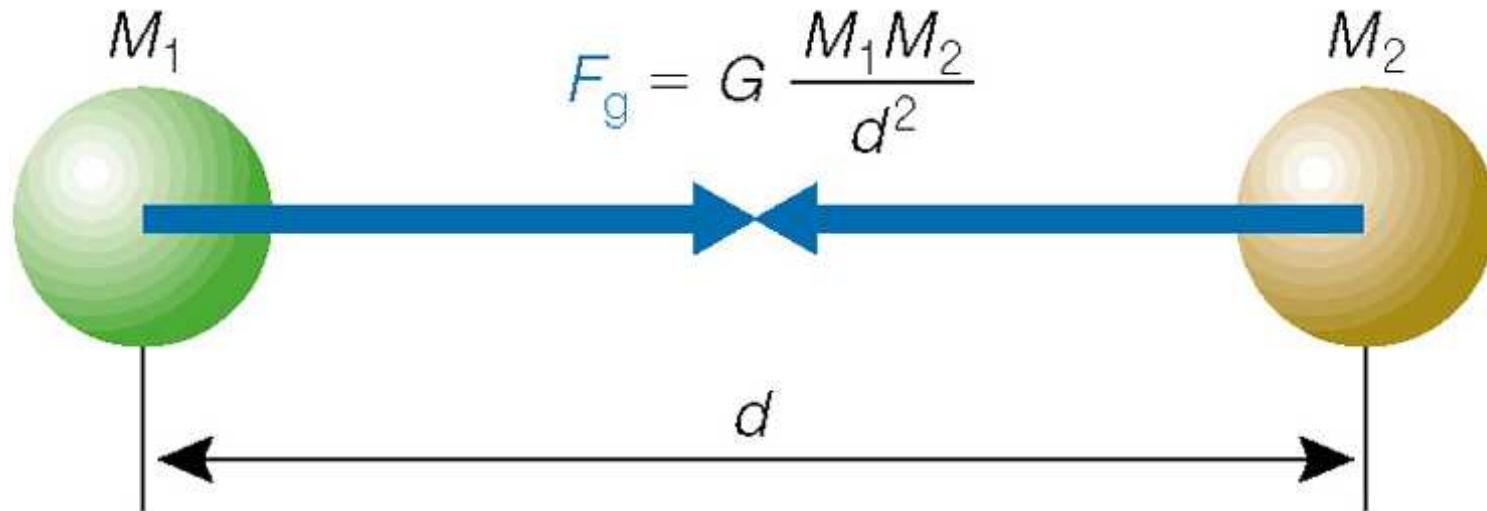
Recent and upcoming topics in class

- The QEDEx tips for understanding and applying laws or formulae
- The Four Fundamental Forces
 - The Force of Gravity : Newton's Universal Law of Gravitation
Einstein's theory of general relativity vs Newton's law of gravity
 - Electromagnetic Forces
 - The Strong force
 - The Weak force
 - Relative importance of the 4 forces : when and where do they matter?
 - attractive vs repulsive
 - long range vs short range

Four Fundamental Forces



Newton's Universal Law of Gravitation



See in class notes: the QEDEx tips for understanding and applying laws or formulae

Newton's Law of Gravity and Laws of Motion



Sir Isaac Newton (1642-1727)

Born in England



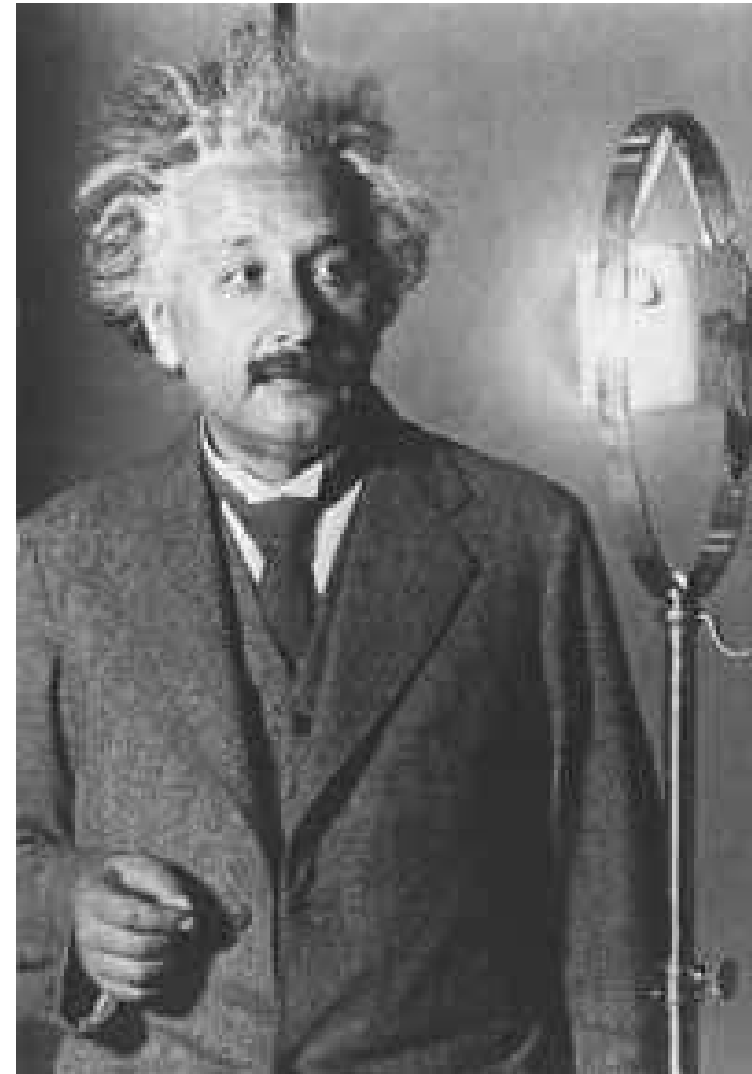
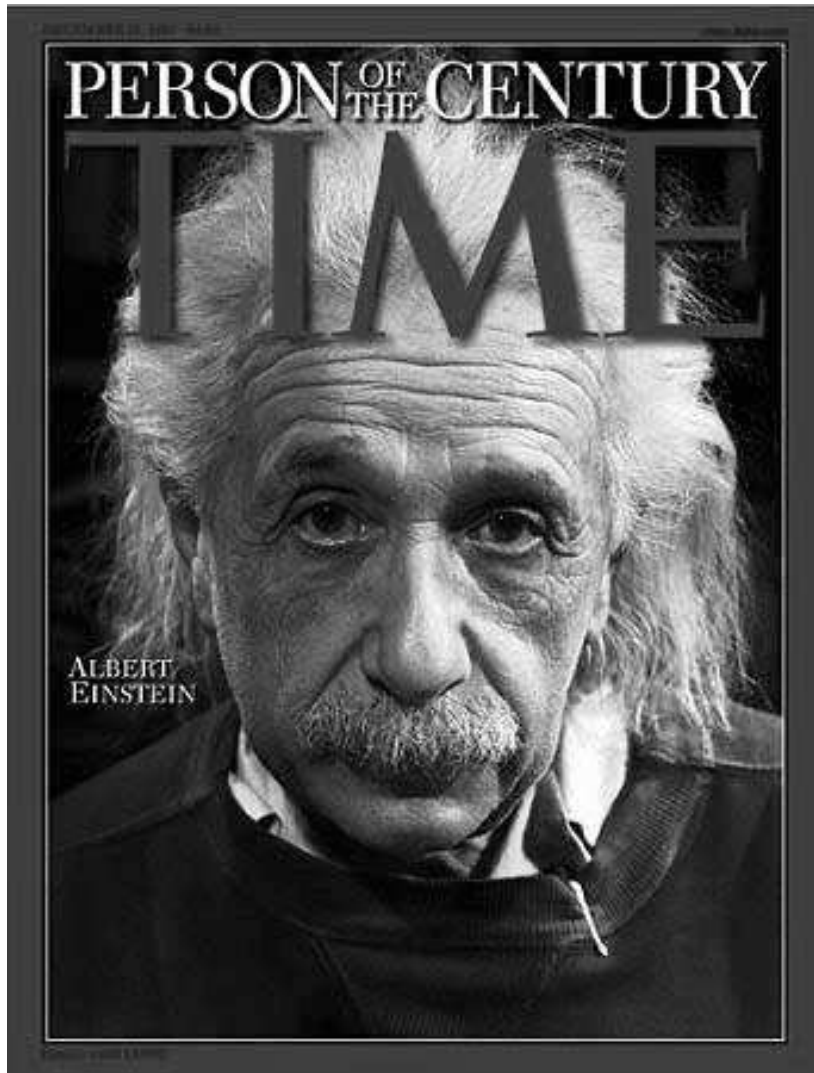
- Student (1661); Lucasian Professor of Mathematics (1669) at Trinity College, Cambridge Univ
- Unified “the Earth and the Heavens” with his laws of gravity and motion (1665-1666)
- Published “Principia” (Mathematical Principles of Natural Philosophy) in 1687

Eintein's theory of General Relativitys



Abell 2218 cluster of galaxies (Region shown = 1.4×10^6 lyr)

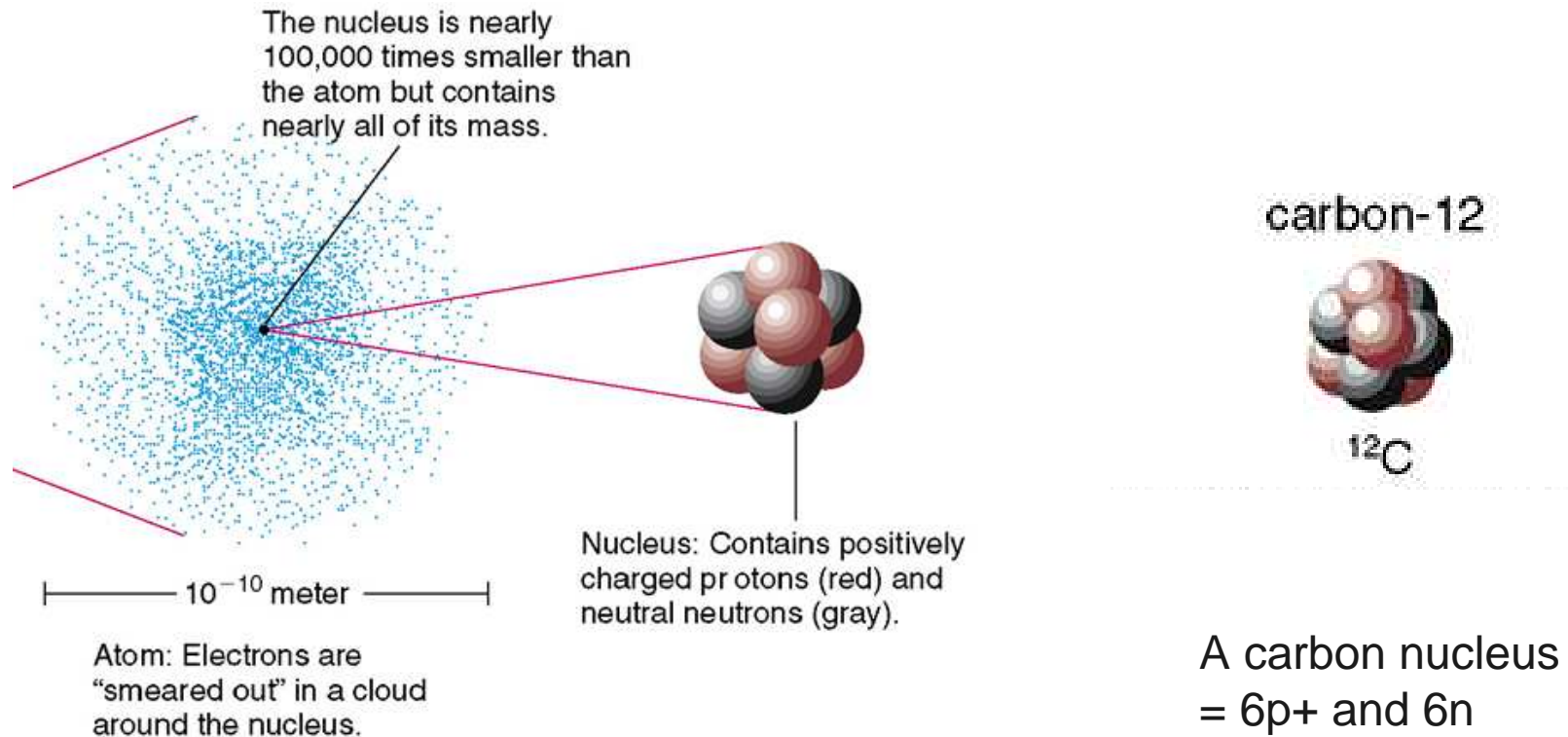
Gravtiational lenses observed à explained by Eintein's theory of General Relativity, but not by Newton's law of gravity



Albert Einstein

- Theory of Special Relativity 1905
- Theory of General Relativity 1916
- The Nobel Prize in Physics 1921

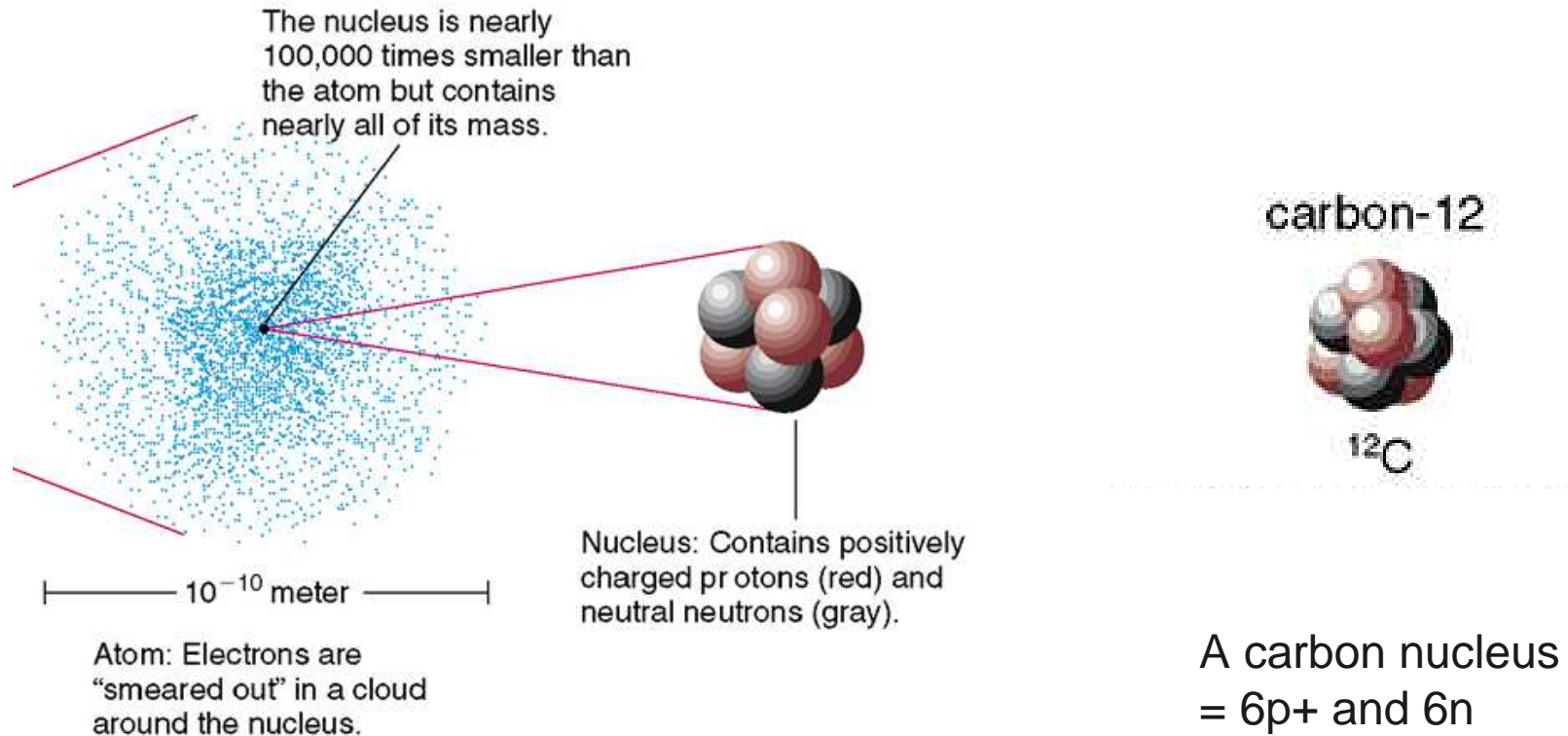
Forces within the nucleus of an atom



A carbon atom is 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

Forces within the nucleus of an atom



A carbon atom is 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