

# Physics 100 - April 16, 2007

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## Presentations

April 16: 17-solar system formation

April 18: ~~2-nuclear bombs~~, 6-GPS, 27-football

April 23: 24A-Feynman, 21-nuclear terrorism

April 25: 18-SETI, 26-music

April 30: 25-comets/mass extinctions, 24-Galileo

May 2: **String Theory, 2-nuclear bombs**

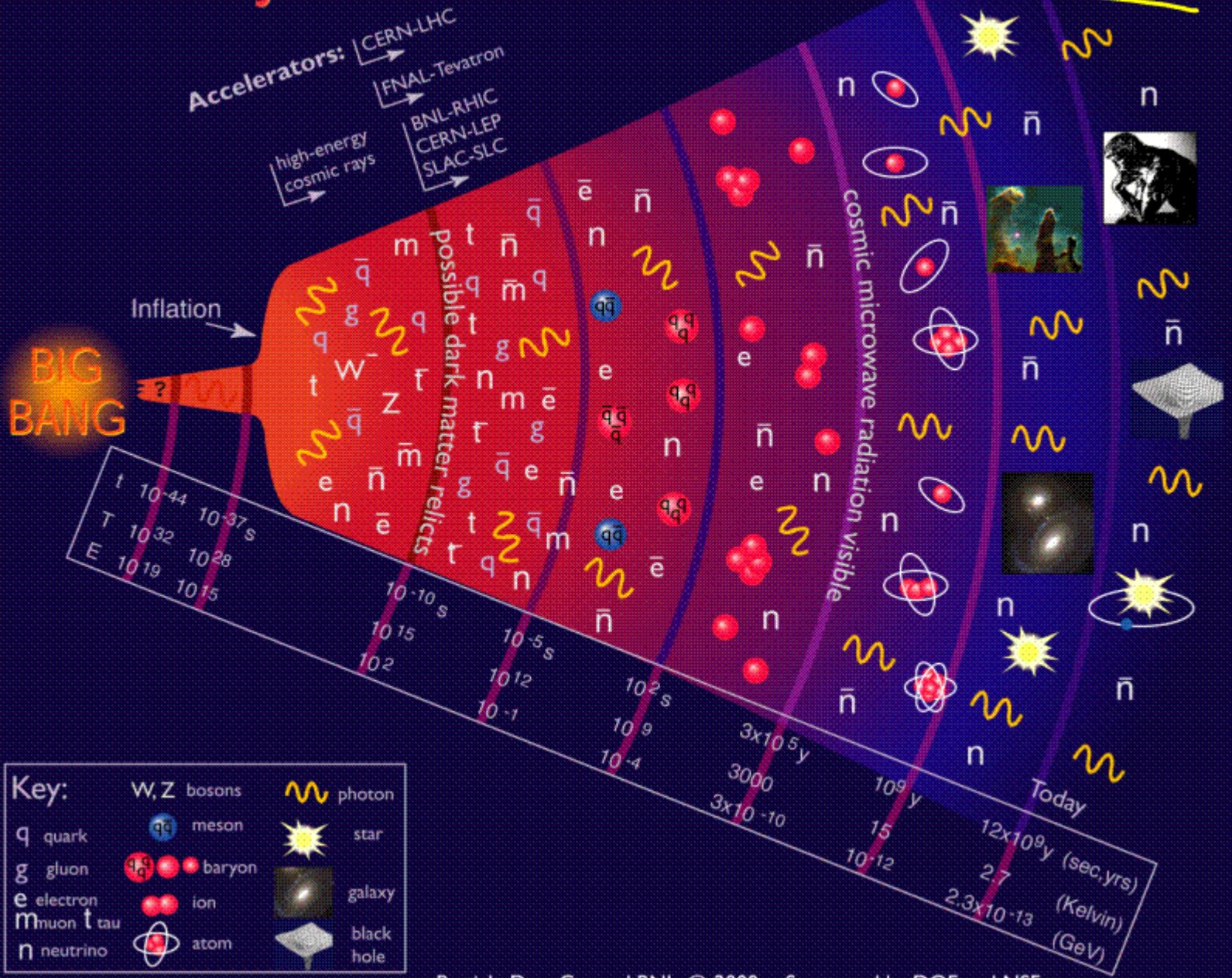
If one of the April 18 groups wants to switch to May 2, let me know ASAP.

Let me know if  
issues/problems

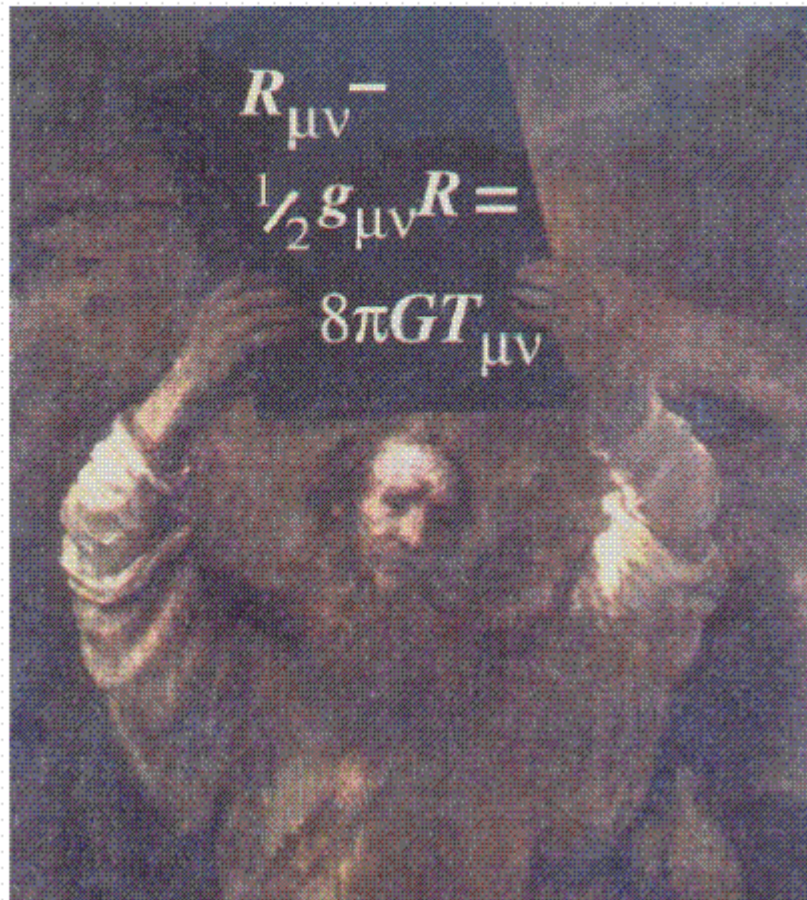
EXAM 2 Still being graded

- hope to Return on Wednesday

# History of the Universe - Current Paradigm



# Why Believe? ...

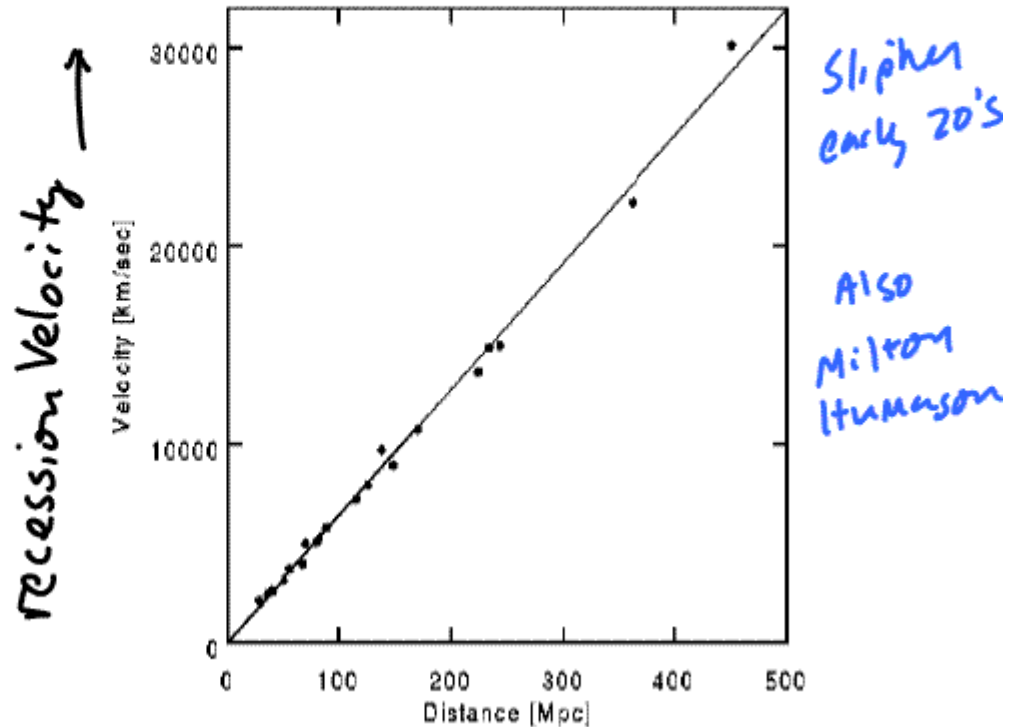


- R. Kolb

We live in an expanding universe



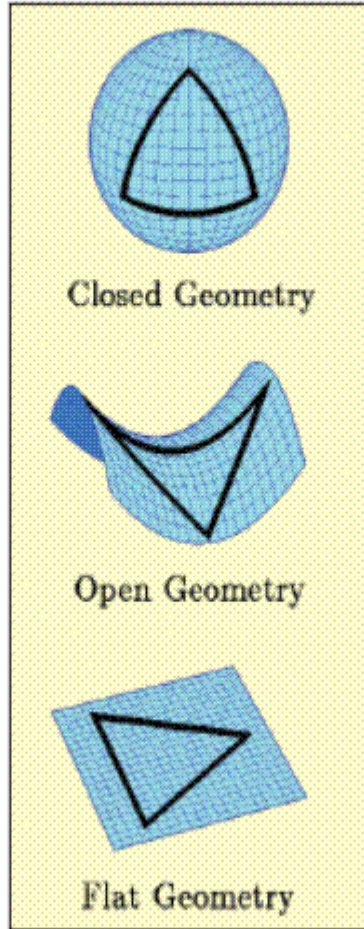
Edwin Hubble  
(1929)



NON-STATIC universe expected from Relativity

Relativity allows space to have different curved geometries?  
Which is our universe?

Flat space is a very special case!



Sum of angles in triangle

$$> 180^\circ$$

$$< 180^\circ$$

$$= 180^\circ$$

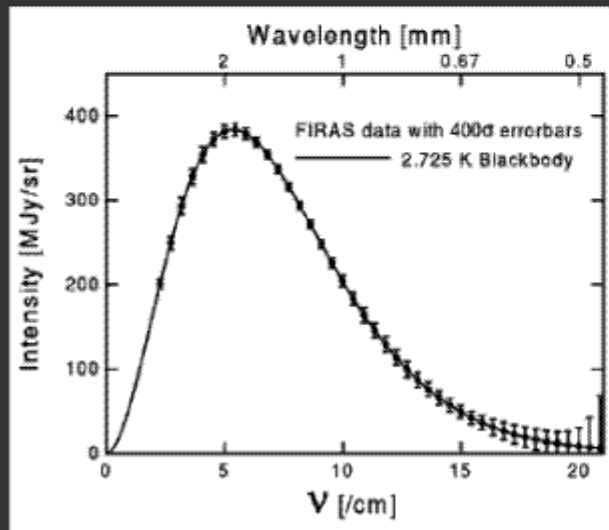
We see "First light"

Redshifted Blackbody radiation from recombination at  $t \approx 100,000$  yrs

Extremely smooth + uniform throughout sky

## Cosmic Microwave Background

Penzias and Wilson - 1964



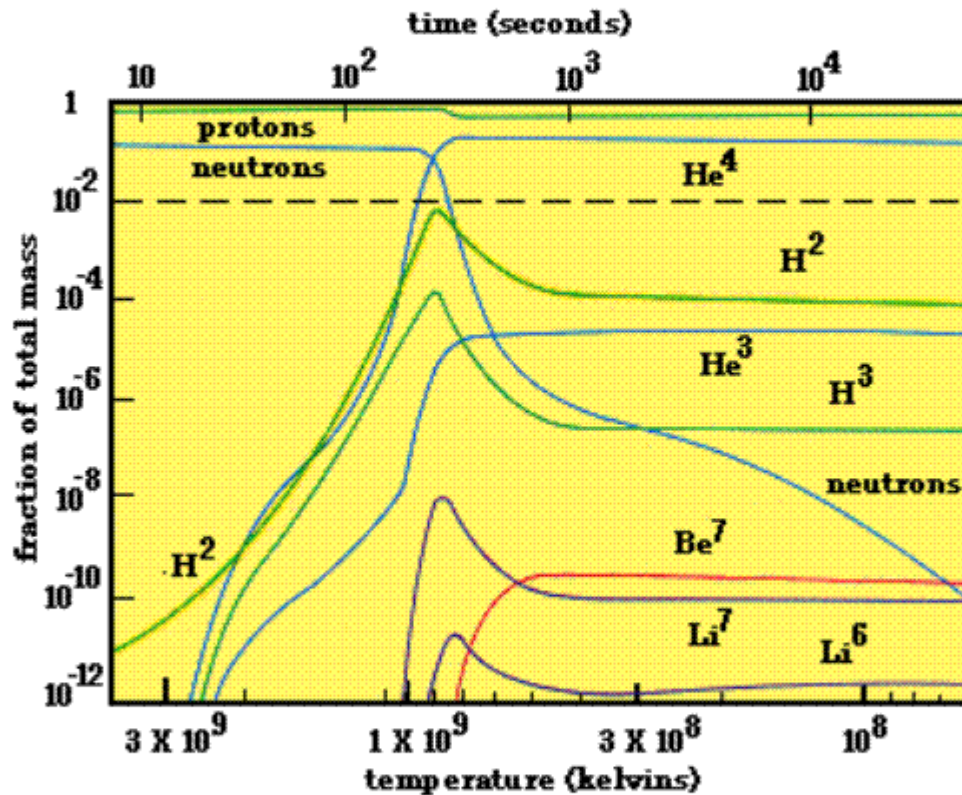
Uniform and isotropic

- in as far as they could measure

1978 Nobel prize

# Big Bang Nucleosynthesis

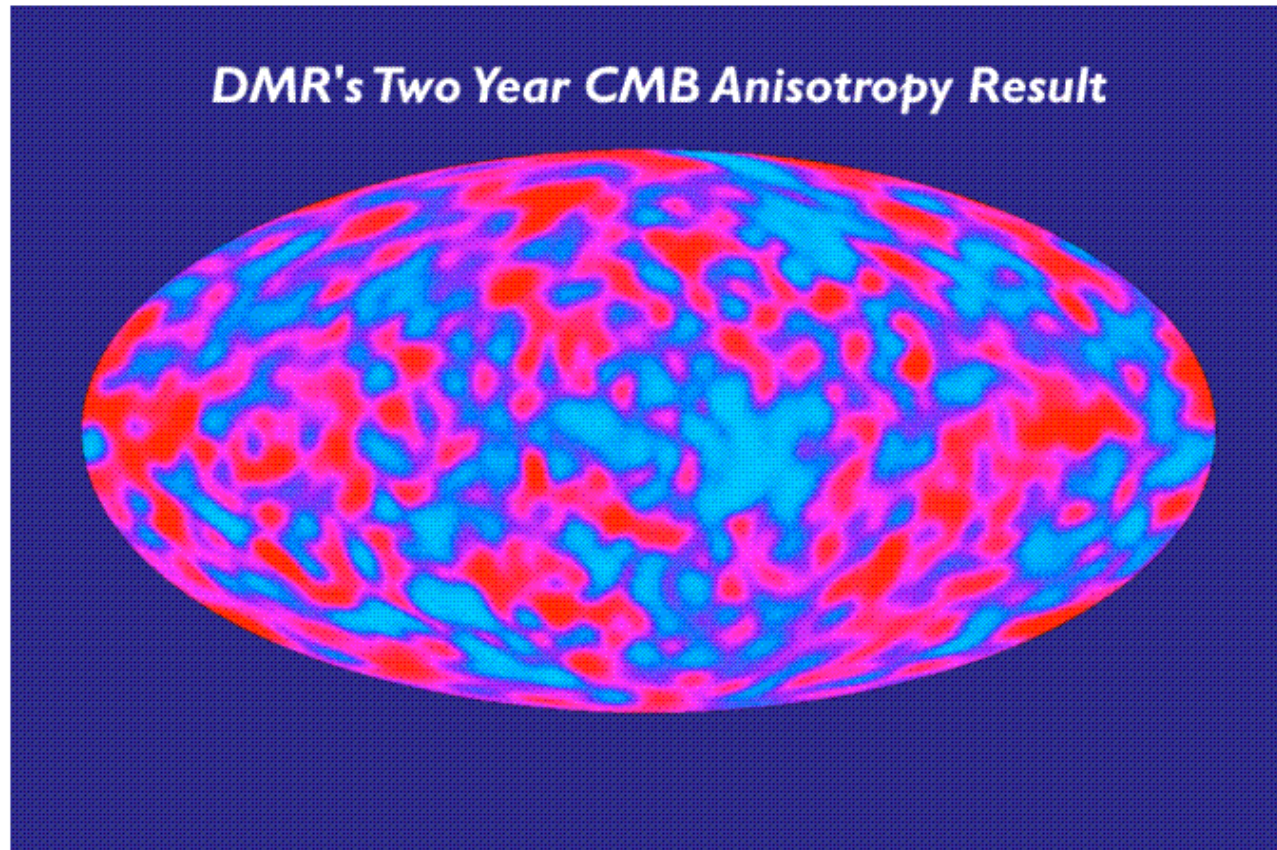
$t \approx 100$  seconds



<http://www.astro.ucla.edu/~wright/BBNS.html>

We see ~expected distribution of light nuclei in universe.

But ... Big Bang CMB cannot be completely uniform because we have galaxies, galactic clusters, etc.



CMB "color" or Temperature seen to vary by 1 part in 100,000

1992 COBE Satellite observation of CMB over all sky

Cosmic Background Explorer