Galaxies: The Universe’s Time Machine

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R. Wechsler, SLAC Kid’s Day 2009
\[ E = mc^2 \]

the speed of light is constant

\[ c = 300000 \text{ km/s} \]

or

\[ 186000 \text{ miles per second} \]

This means we never really see things in the present!
The Sun

93 million miles away

= 8.315 light minutes away

This means we always see the sun as it was 8 minutes ago!
Pluto is much farther...

we see Pluto as it was 4 hours ago!

~4 light hours
How about the nearest star?

Proxima Centauri ~ 4.3 light years
How about the nearest big galaxy?

~ 2.9 million light years

But galaxies are very old -- Andromeda is about 12 billion years old. Still only middle aged. Compare 2.9 million/12 billion... if Andromeda was as old as the president (48 years), it’s like observing it 5 days ago.
If we want to see galaxies when they were younger, we will have to look a lot farther away.
The zoo of nearby galaxies...
Characterizing Galaxy Morphology...

If you want to classify your own galaxies, check out http://www.galaxyzoo.org/

R. Wechsler, SLAC Kid's Day 2009
The Modern Hubble Sequence

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Galaxies also merge...
To see as far back as possible, we need to look for a long time with a good telescope...
Hubble ACS imaging of the Extended Groth Strip
if we look back in time, the average galaxy should be younger

a snapshot of the universe at half its present age
Now let’s go even deeper...
The farthest galaxies in this image emitted their light when the universe was more than 13 billion years old, just a few hundred million years after the big bang!
There is lots more to explore!

- slides, movies, and more material available at:

  http://risa.stanford.edu/kidsday.php