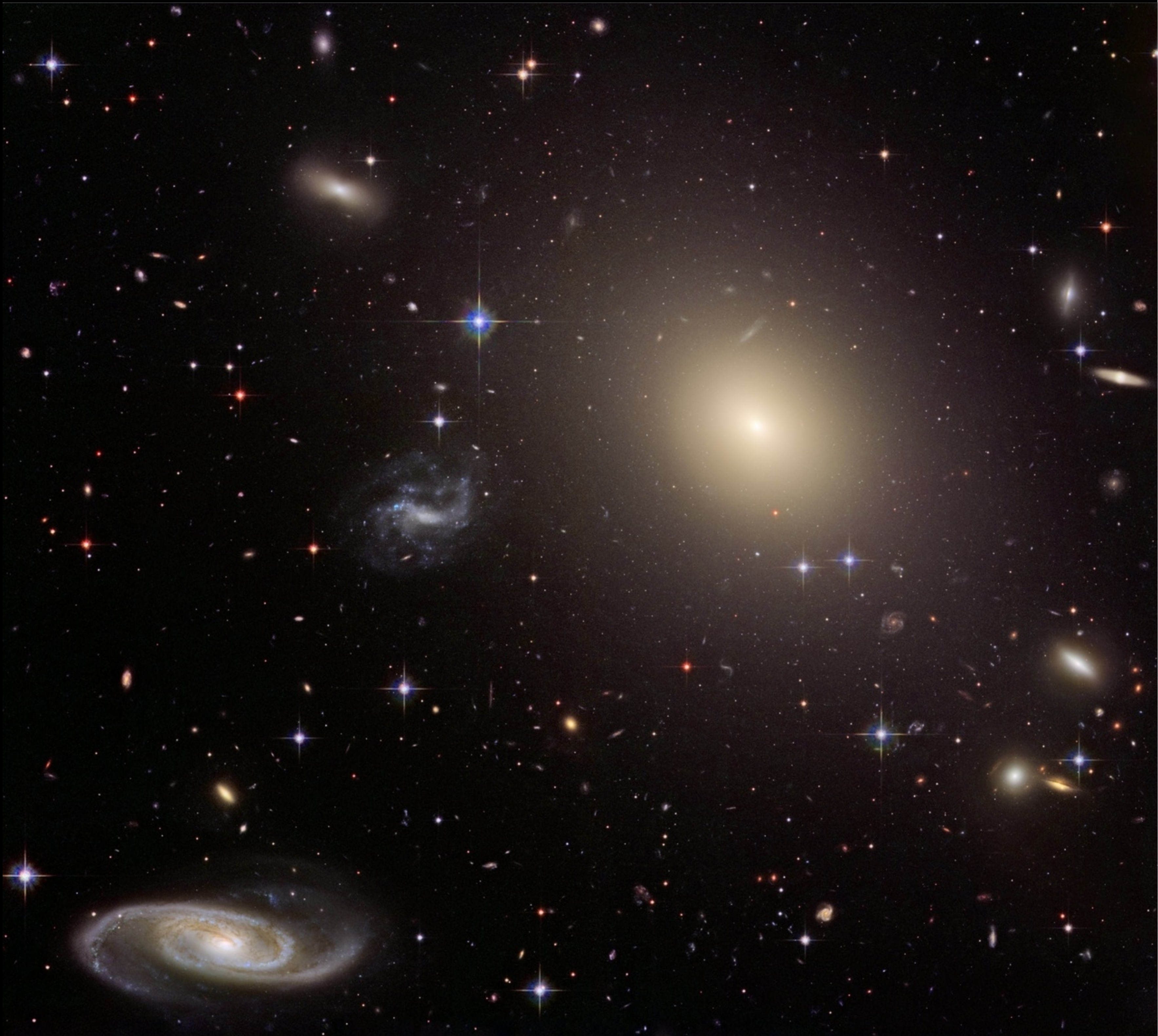
THE HUBBLE LAW



Why are we doing this lab?

The Universe is a big place and it seems to be getting bigger (that is, it's expanding). This was first determined by Hubble in the 1920s and we're still trying to accurately measure it.

You're going to examine the age and size of the “observable” Universe using simulated observations of galaxies. This measurement is the basis of cosmology!

Distant Galaxies = Looking Back in Time!

Light travels at a finite speed (300 000 km/s)

Thus, it takes light a finite amount of time to travel somewhere

The Sun is 8.5 light minutes away. That means...

1) It takes light 8.5 minutes to reach us

2) If the Sun were to vanish, we wouldn't know for 8.5 minutes

Distant Galaxies = Looking Back in Time!

Light travels at a finite speed (300 000 km/s)

Thus, it takes light a finite amount of time to travel somewhere

9.5 x 10^18 km away

1 million light years

A galaxy 1 million light years away means:

1) It takes light 1 million years to reach us

2) We are seeing that galaxy as it was 1 million years ago!

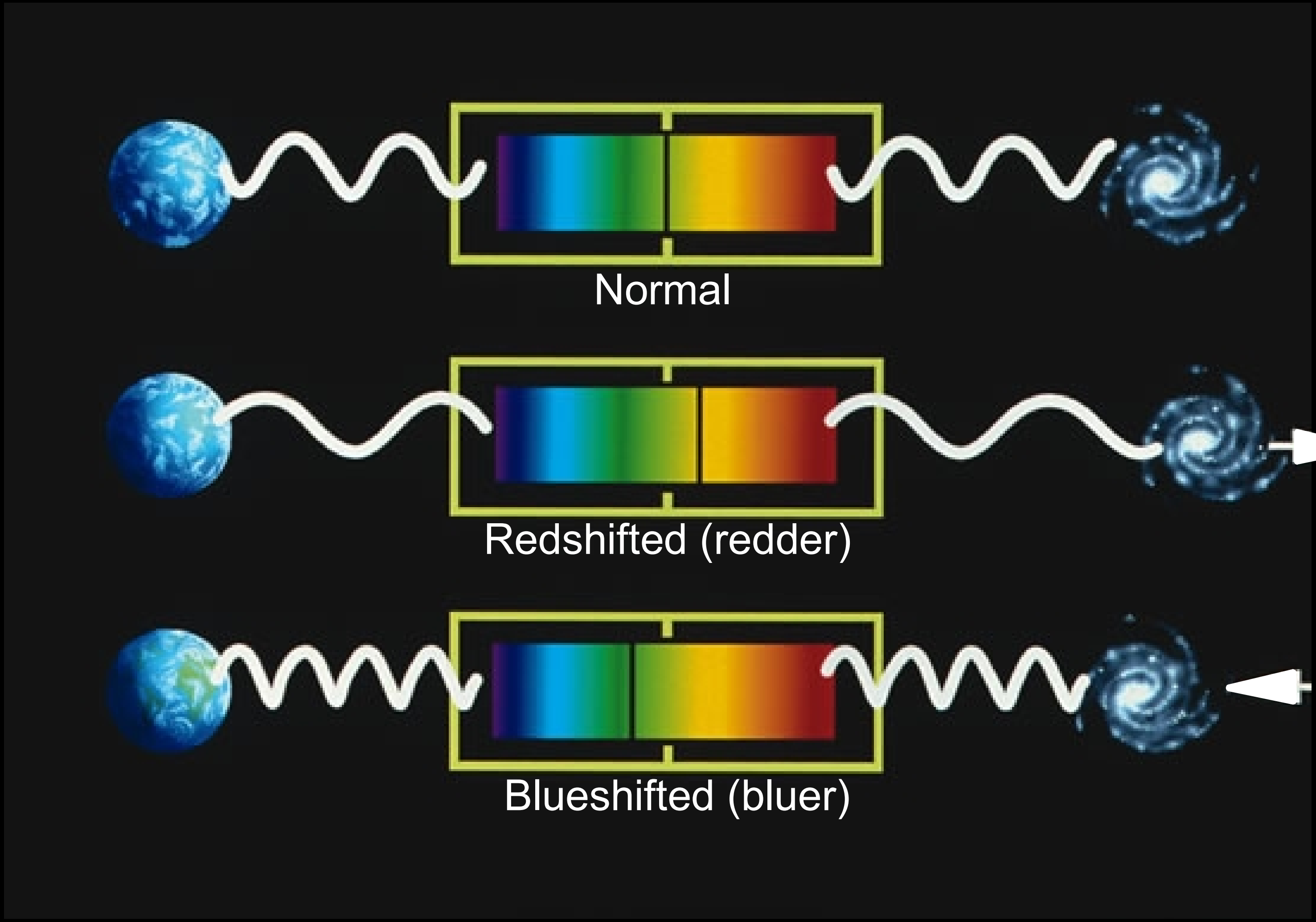
Distant Galaxies = Looking Back in Time!

Redshifts vs Blueshifts

http://www.youtube.com/watch?v=4cCk1MXJHm0

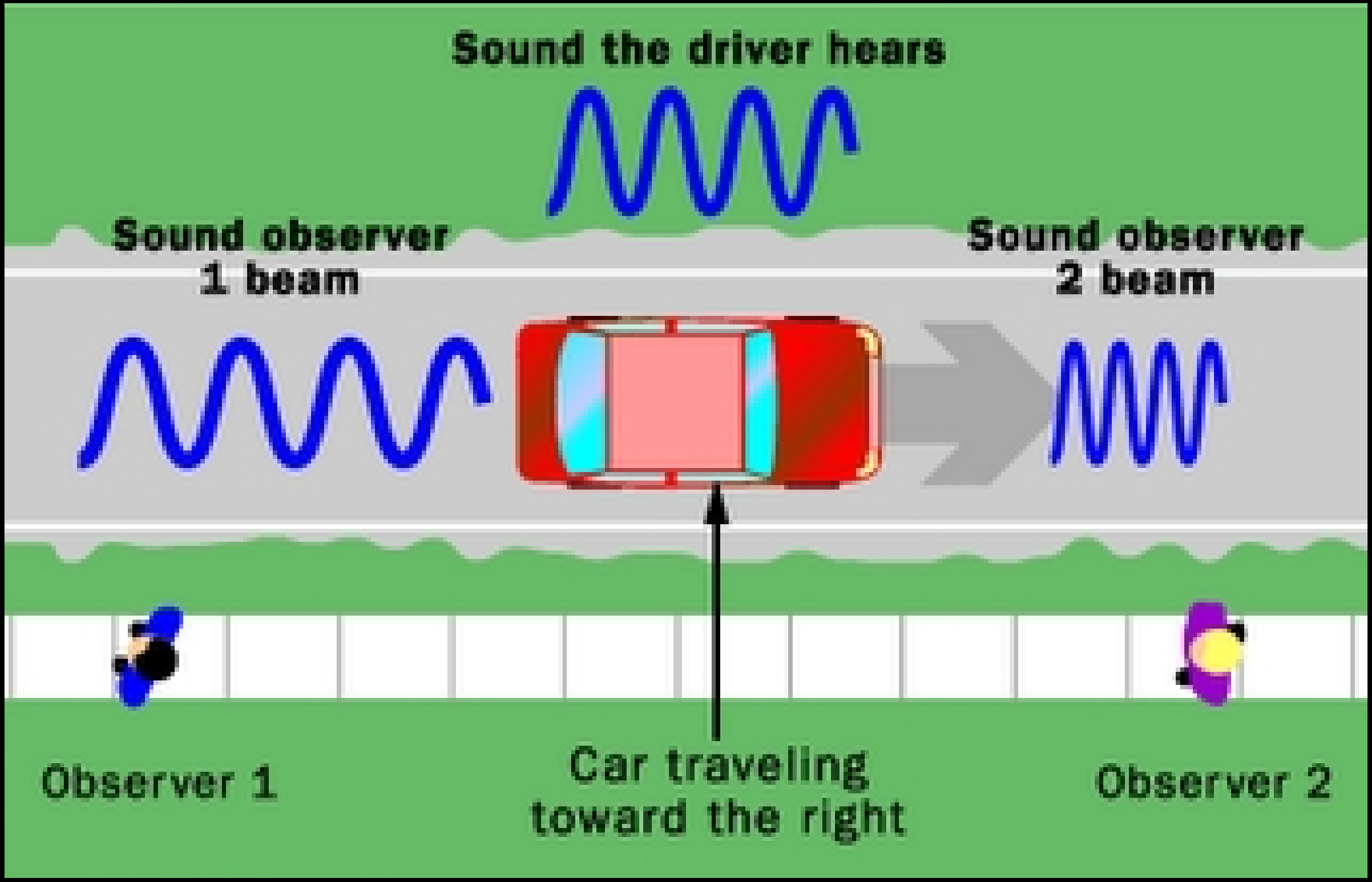
Distant galaxies are red

Redshifting implies they are moving away from us.



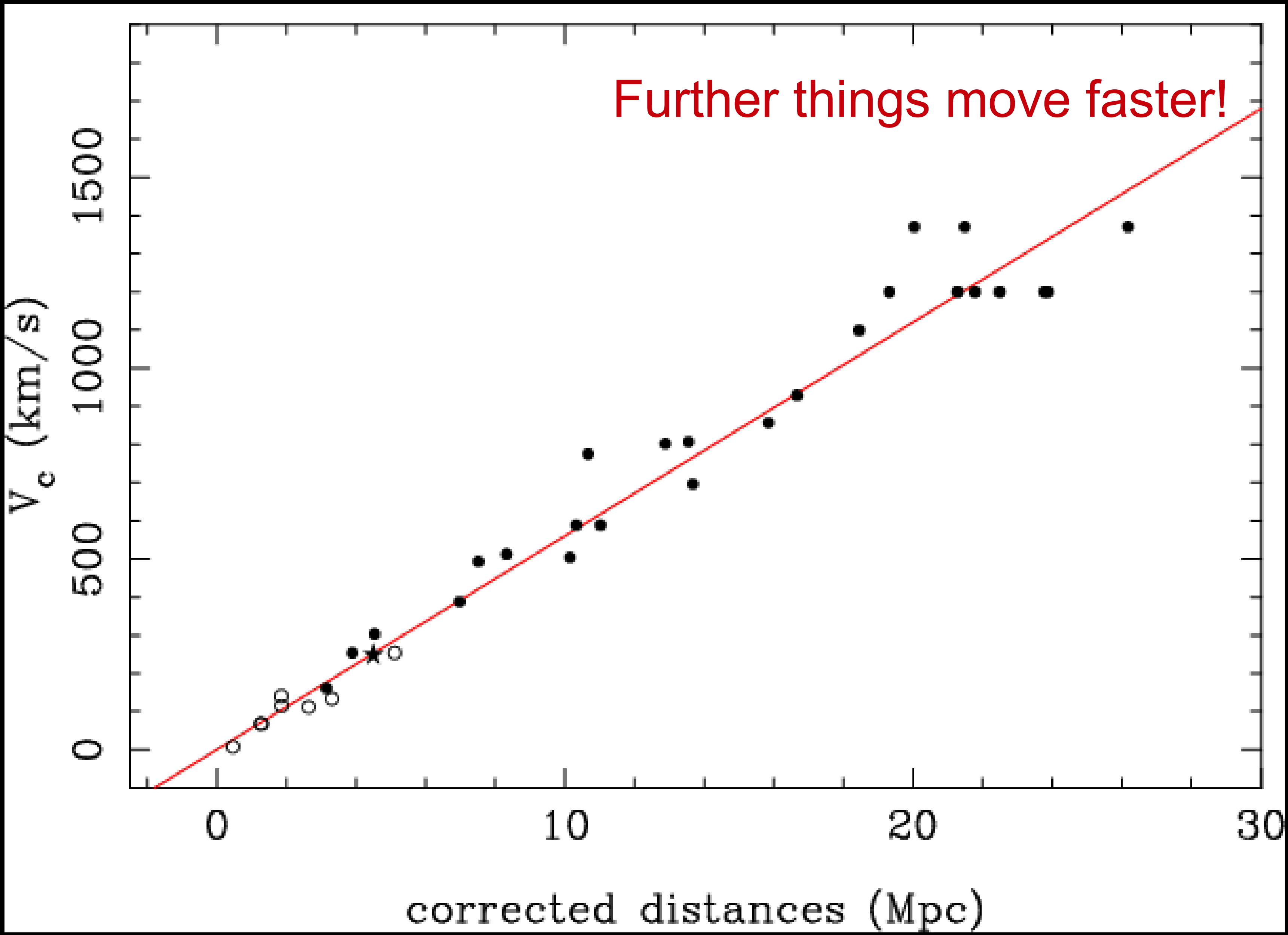
Distant galaxies are Redshifted

Therefore, distant galaxies are moving away from us.



Hubble Law

R e d s h i f t s p e e d

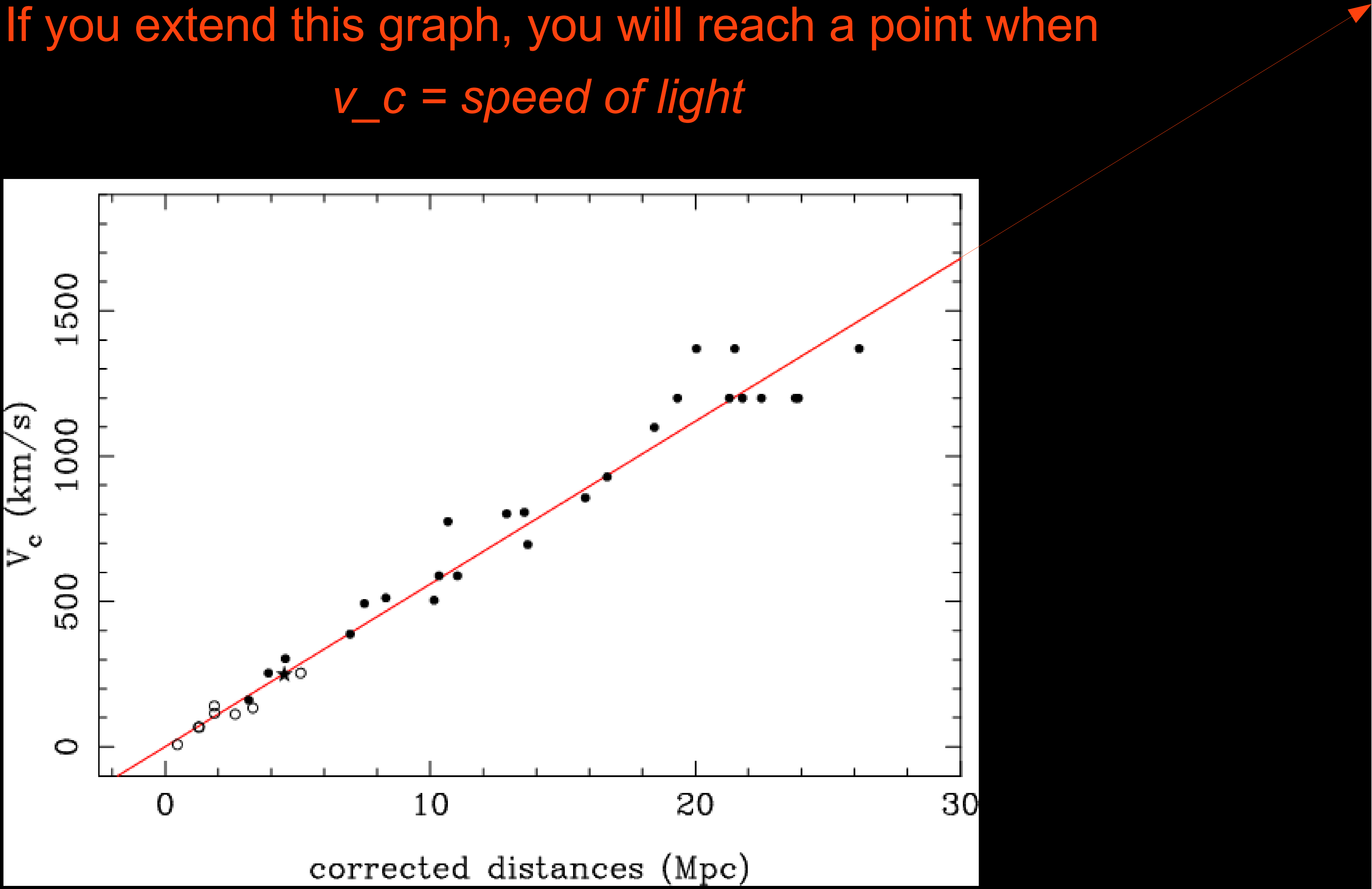


Distance from us (in 1 million pc or in Mpc)

The Observable Universe

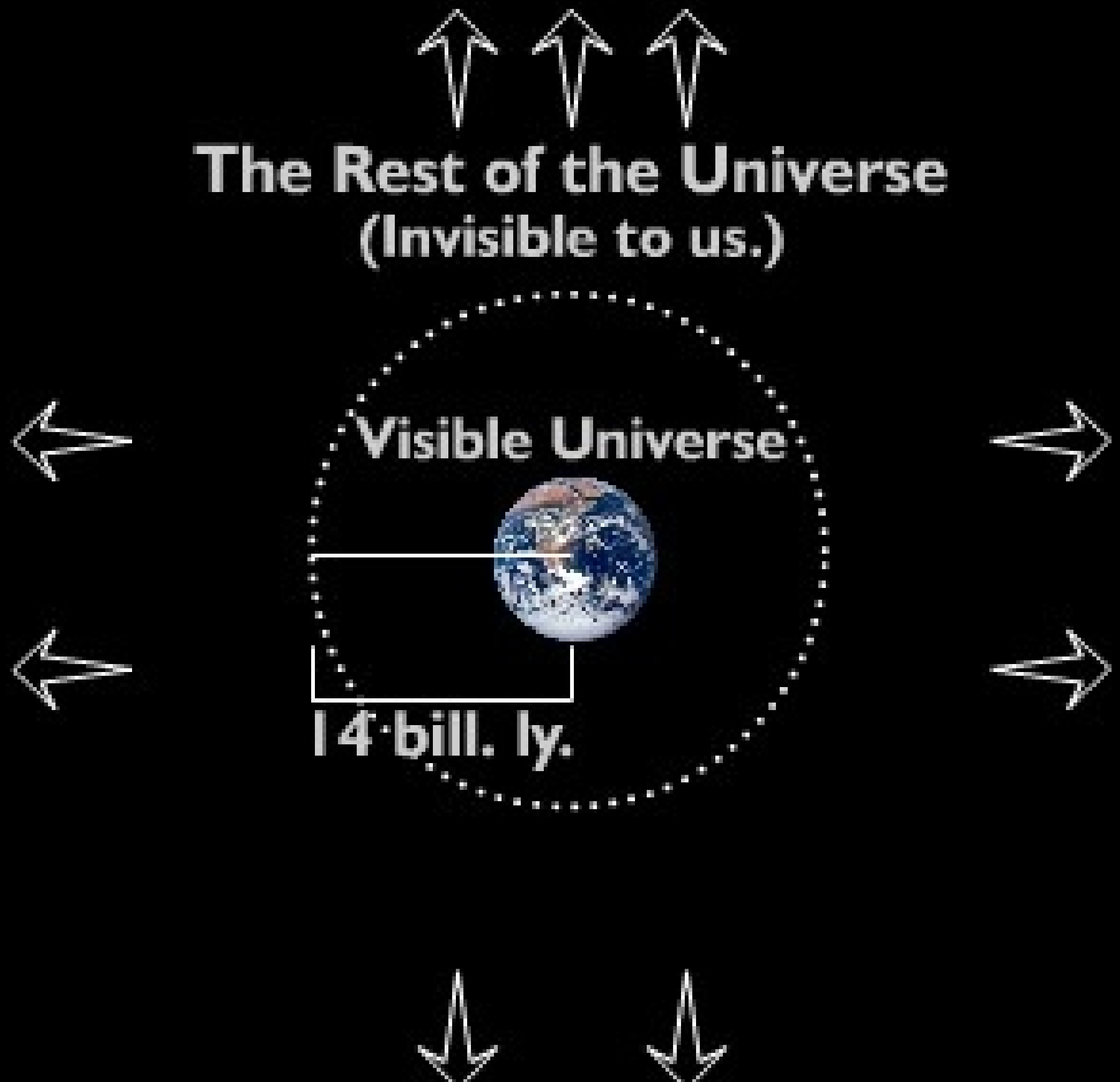
If you extend this graph, you will reach a point when

v_c = speed of light



The Observable Universe

You cannot see beyond this point!



The Lab

You're going to look at galaxy clusters and measure the their velocity from their spectra.

Assuming all bright clusters galaxies have the same absolute magnitude, you can get their distance.

With this information, you will make a Hubble Diagram and find the Hubble constant, size of the Universe and age of the Universe.