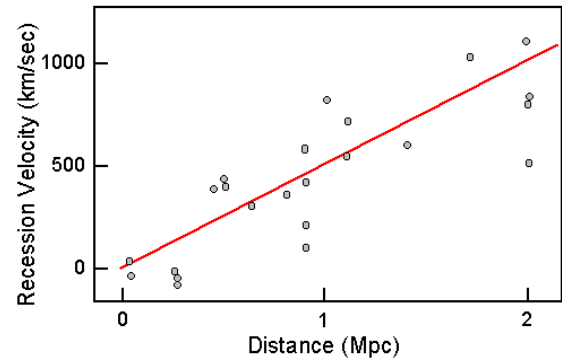


1. We know that the Universe is expanding.



image credit: NASA and ESA

Hubble's Data (1929)



2. And it is an accelerated expansion.

Hubble Plots

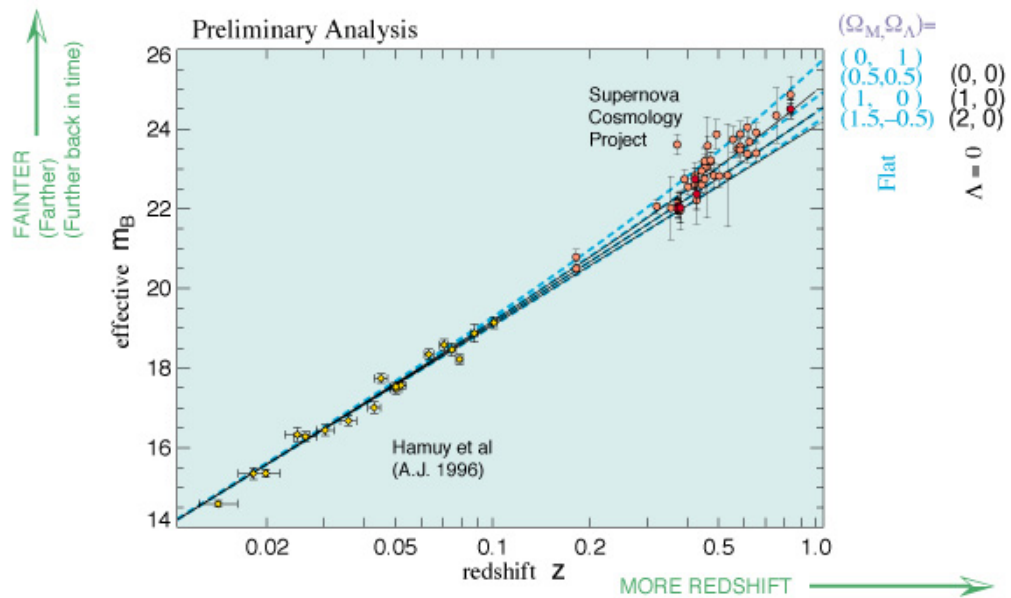


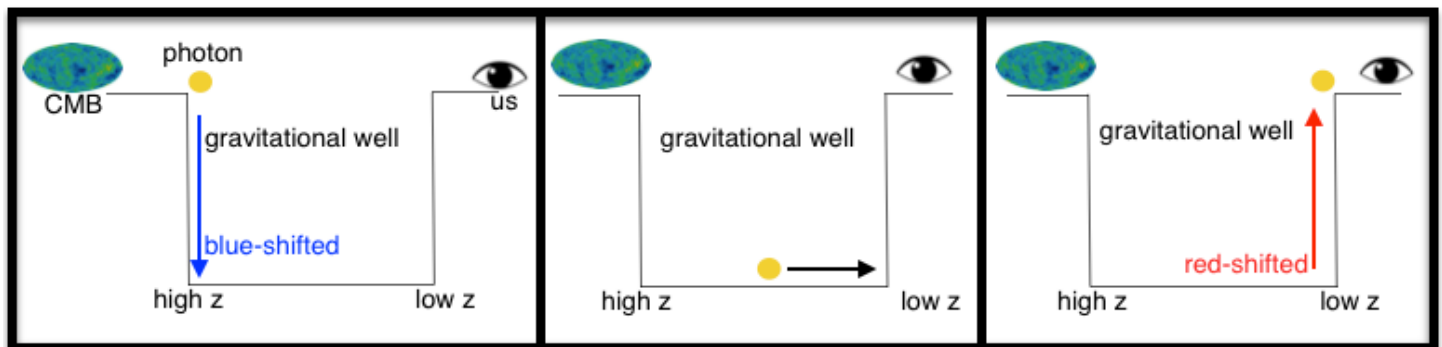
image credit: David Spergel

3. Dark energy is thought to cause the accelerated expansion, but nobody knows what dark energy is ...



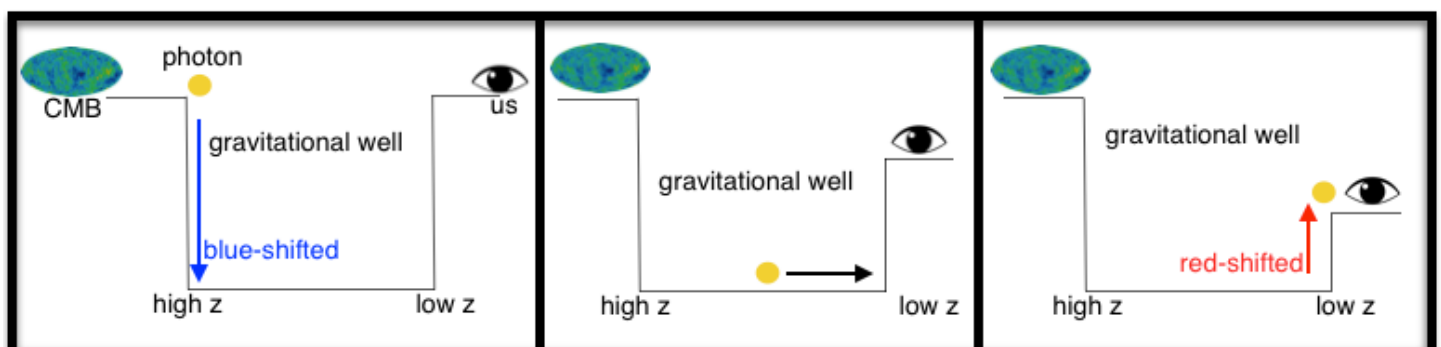
4. Integrated Sachs-Wolfe effect (ISW) might give a hint to us. ISW effect: Gravitational wells would decay with time because of the existence of dark energy. Thus, when photons pass through a gravitational well, the red-shiftings of the photons can not compensate the blue-shiftings, which cause a hot spot on CMB.

If there is no DE:



→ red-shift = blue-shift

If there is DE:



→ red-shift < blue-shift → A hotspot on CMB temperature map

5. We can use galaxies as a tracer for gravitational well, and the correlation between the CMB temperature map and galaxy map can help us to understand dark energy.

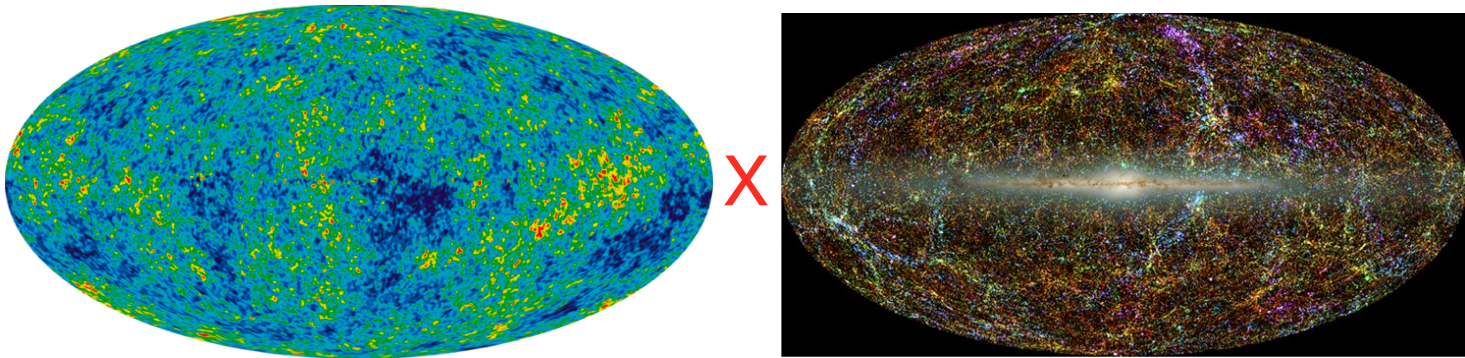
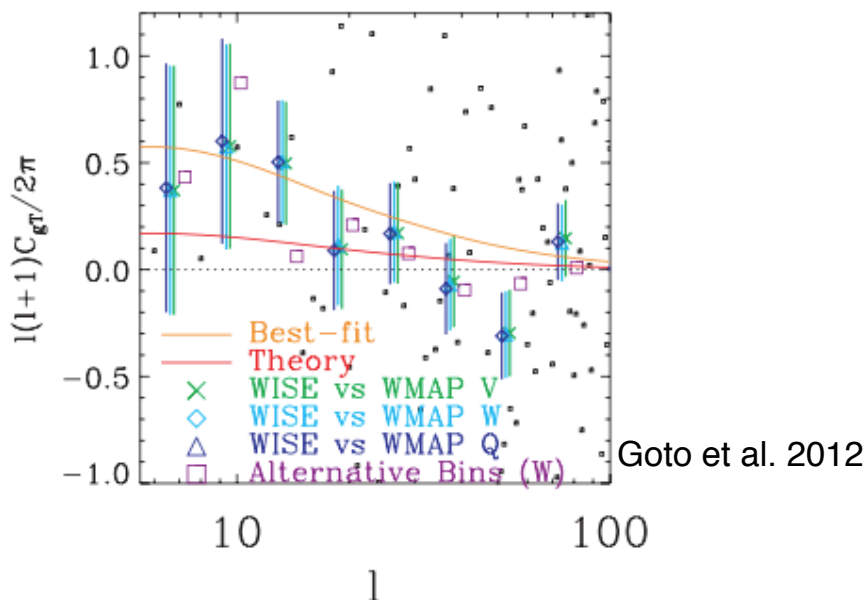
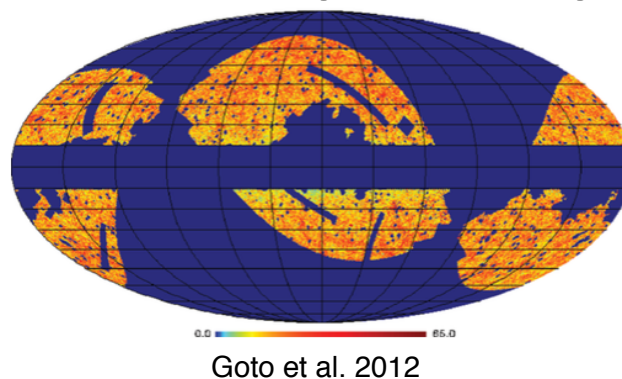


image credit: WMAP and WISE



6. To correctly get the correlation, we need a good sample of galaxies. So the method used to select galaxies from catalogues is a big issue.



7. With a good sample, we can calculate the correlation in high significance. And we are also expecting the coming Planck data release and other sky survey for galaxy!