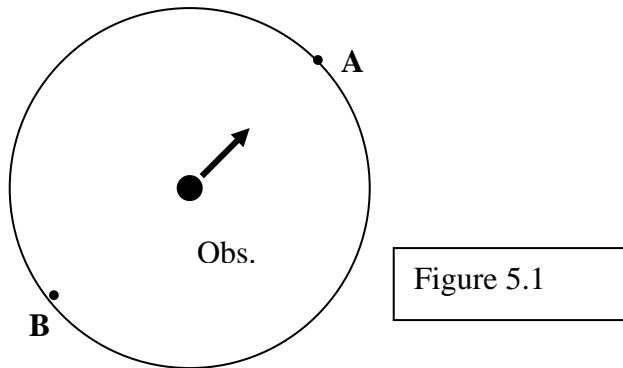


Phys 10 Homework 5 (Due Feb 12 9:45am in class)

Assigned: Feb 5

5.1 Figure 5.1 shows an observer today (large black dot) moving in the direction shown by the arrow, and a circle representing the last scattering surface for that observer.

The motion of the observer changes the apparent temperature of a given point on the sky. How do the temperatures measured at points **A** and **B** compare?



5.2

a) Sketch a figure similar to figure 5.1, but this time assume the observer is not moving relative to the surface of last scattering.

Now imagine a 2nd observer living at point **A**. It turns out there can be many different definitions of time in different parts of the universe, but in a homogeneous expanding universe (such as the one in which we live) temperature provides a good measure of time (temperature decrease as time increases). Due to the delay caused by light travel speed, we see position **A** as it was when the temperatures was around 3,000K, except with the observed temperature reduced by the cosmic expansion.

b) On your sketch, draw observer **A**'s last scattering surface as it appears when she observes a temperature of around 2.7K. Take care to show the right position of this new last scattering surface compared with the point marked "Obs."

c) Roughly, what does observer **A** see when she looks in the direction of "Obs."?

d) Imagine observer **A** and her descendants continue to look in the direction of "Obs." for billions of year, and they focus on the events actually taking place for the matter located

at “Obs.” (this matter will expand away, but not as fast as the ever-receding last scattering surface). Name two events that observer at **A** see at “Obs.” as they continue to watch. *Comments: assume the light remains detectable, even as the expanding universe continues to increase its wavelength as it travels. Also, this is an open ended question. There are more than two correct events you could name. It will help to think about the fact that generally speaking different regions of the universe have very similar histories, due to the homogeneity.*

Important: Use your sketch from part 5.2a) to think about the other parts of problem 5.2 (rather than figure 5.1 from this sheet).