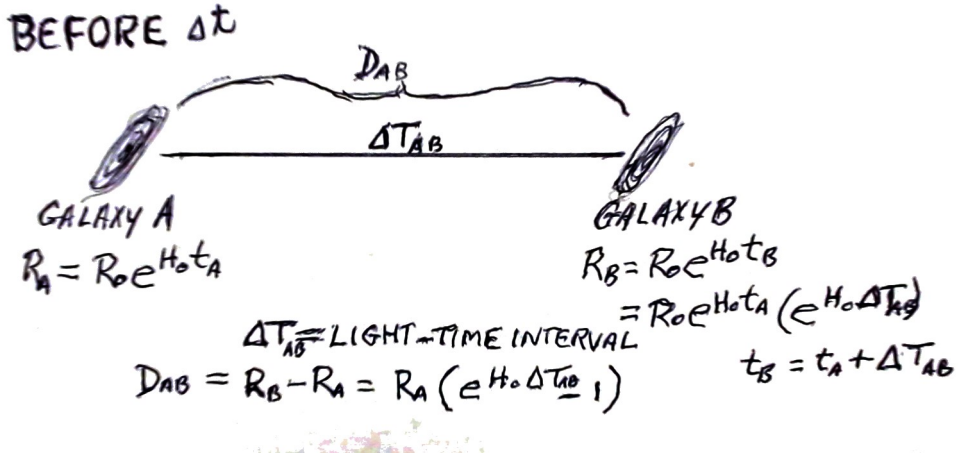
EQUATIONS OF MOTION OF THE UNIVERSE

TIME SEPARATION OF PROPER GALAXIES

33AA M.D.Earl 2023

We have seen that the distance between galaxies in the proper flow increases with time. All proper galaxies move at light speed co e^Hot with respect to a stationary universe in accordance with the Hubble/LeMaitre (H/L) Law. It may seem evident that, since the separation between galaxies increases, it will take light an increasing period of time to span the gap. The λCDM model suggests this, and therefore predicts a darkened sky in the distant future as the galaxies recede. But the exponential expansion (XPXP) math tells a different story:

Figure 33-1. Initial positions of two galaxies - before displacement of Δt



D_{AB} = Initial distance between galaxies
ΔT_{AB} = Light-time interval between galaxies where **$t_B = t_A + \Delta T_{AB}$**

In Figure 33-1, because the proper galaxies are moving at (proper) light speed, **ΔT_{AB}** represents the initial light-time interval between galaxy A and galaxy B

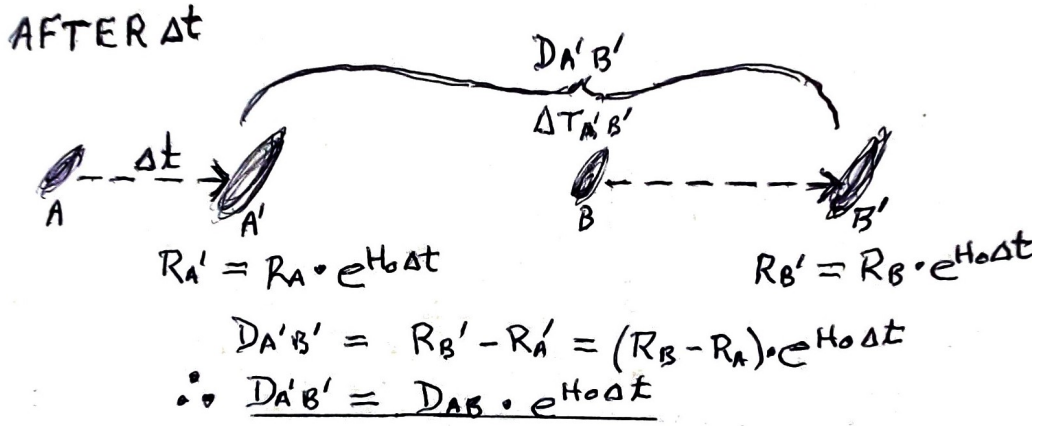
$$R_A = Ro\, e^{Hot_A} \qquad R_B = Ro\, e^{Hot_B} \qquad t_B = t_A + \Delta T_{AB}$$

$$R_B = Ro\, e^{Ho(t_A + \Delta T_{AB})}$$

$$D_{AB} = R_B - R_A = Roe^{Hot_A} \cdot e^{Ho(\Delta T_{AB})} - Ro\, e^{Hot_A} = Roe^{Hot_A} \cdot (e^{Ho(\Delta T_{AB})} - 1) \qquad \langle 1 \rangle$$

Equation [1] is an expression for the separation of the galaxies as a function of **ΔT_{AB}**. It will next be shown that the light-time interval between proper galaxies is unchanging, therefore the wavelength of light received by galaxies is unchanging.

Figure 33- 2. Both galaxies move to new positions after some Δt



Separation of galaxies after Δt :

$$D_{A'B'} = R_{B'} - R_{A'} = Ro\, e^{Hot_B} \cdot e^{Ho\Delta t} - Ro\, e^{Hot_A} \cdot e^{Ho\Delta t}$$
$$= (Ro\, e^{Hot_B} - Ro\, e^{Hot_A}) \cdot e^{Ho\Delta t} = D_{AB} \cdot e^{Ho\Delta t}$$

THIS INDICATES THAT THE <u>DISTANCE</u> BETWEEN GALAXIES INCREASES BY A FACTOR OF e^HoΔt AFTER Δt.

From figures 1 and 2, two expressions for $D_{A'B'}$, in terms of ΔT_{AB} and $\Delta T_{A'B'}$, are derived:

$$D_{A'B'} = Roe^{Hot_A} \cdot (e^{Ho(\Delta T_{AB})} - 1) \cdot e^{Ho\Delta t} \qquad [1]$$
$$D_{A'B'} = R_{B'} - R_{A'} = Roe^{Hot_A} \cdot e^{Ho\Delta t} \cdot e^{Ho(\Delta T_{A'B'})} - Roe^{Hot_A} \cdot e^{Ho\Delta t}$$
$$= Roe^{Hot_A} \cdot e^{Ho\Delta t} \cdot (e^{Ho(\Delta T_{A'B'})} - 1) \qquad [2]$$

Equating and canceling common terms in expressions [1] and [2]:

$$(e^{Ho(\Delta T_{AB})} - 1) = (e^{Ho(\Delta T_{A'B'})} - 1)$$

leading to:

$$\Delta T_{AB} = \Delta T_{A'B'}$$

for proper galaxies

<u>THIS RESULT SHOWS THAT THE LIGHT-TIME INTERVAL BETWEEN PROPER GALAXIES DOES NOT CHANGE !!!</u>

It implies several important characteristics of universal motion, some of which are:

- T_o, (the “Hubble Time”), is constant, because the light-time interval to the farthest (proper) galaxy is constant. The inverse of To, is H_o, and is therefore also constant.

- The redshift of proper galaxies does not change because the shifted wavelength of light is a function of an unchanging ΔT. (see wavelength shifting)

- Galaxies will not “fade to darkness” in the distant future, as predicted by the λCDM model.

- The observer and measuring devices are expanding concurrently with the cosmic expansion. XPXP suggests an eternal “expansion from within”, wherein all things exponentially expand in all scales, and no BIG BANG happened.

-XPXP opens a new possibility for cosmic agreement with quantum physics..