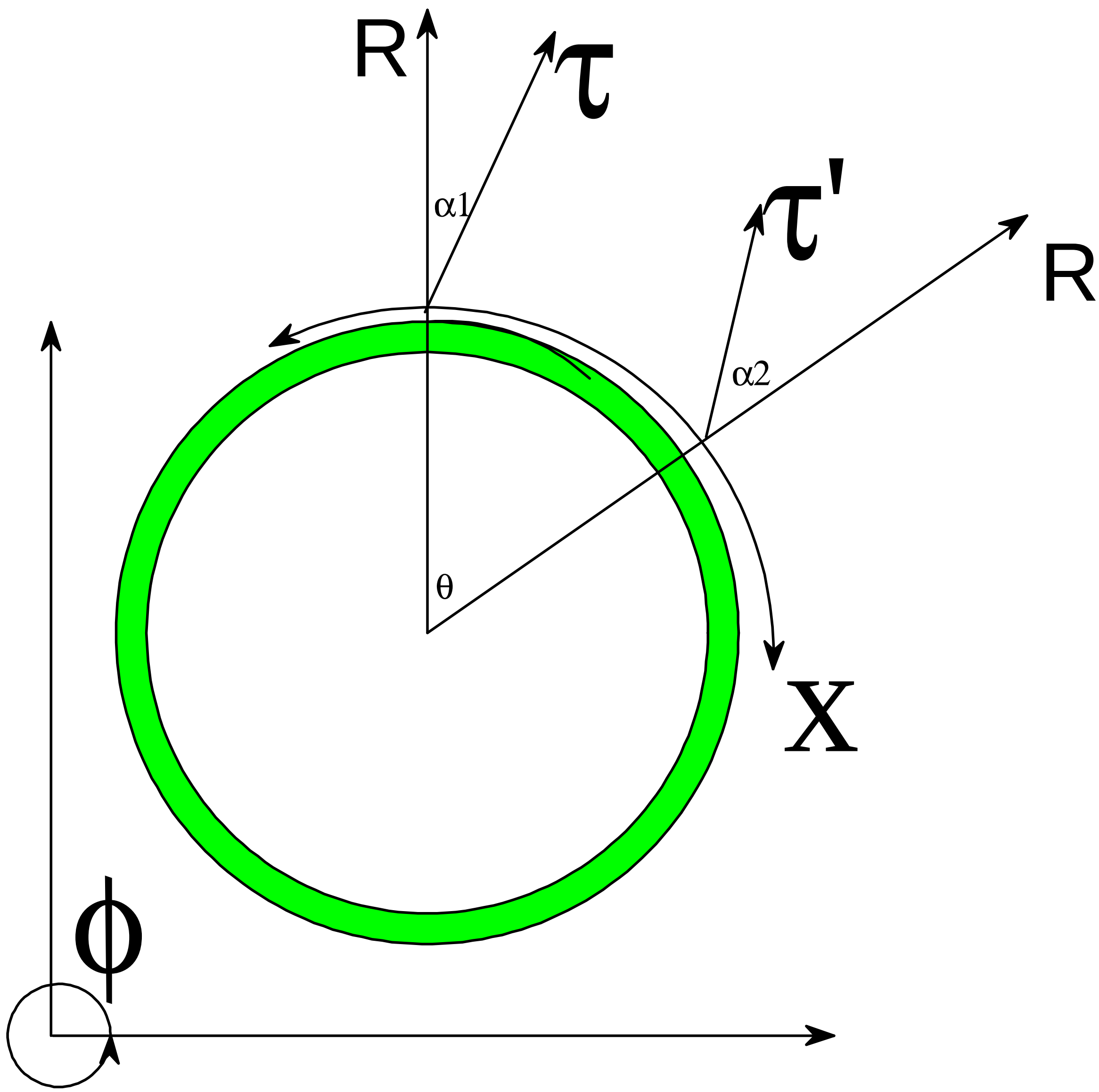

Figure 1. Shows the cross-section Xτ for the expanding Universe. The Universe length along X is represented by the band. X (or Y or Z) is displayed along the perimeter of the circle. Also shown in the diagram is Φ (Cosmological Time) and Radial Time R and the Dimensional Times τ_1 and τ_2.

Notice that:

1. $|R|$ is $|\Phi|$ and it is equal to c * Age of The Universe.
2. R is perpendicular to Φ.
3. The direction τ is the direction of R if one rotates R by α_1 degrees around the axis perpendicular to R and X. This direction corresponds to the direction of a body traveling away from $R\tau_1$ (intersection of R and τ_1) with a velocity equal $v=c*\tan(\alpha_1)$.
4. The Lorentz transform associated with that motion is equivalent to a rotation of an angle α_1= arctanh(v/c) around a direction perpendicular to X and Φ.
5. This is the Lorentz transform which is responsible for keeping the maximum speed as the speed of light.
6. Thus one can think about α_1 as arctanh(v/c) when considering the time rotation (rotation around the direction perpendicular to X and Φ) and as arctan(v/c) when considering the spatial rotation (rotation around the direction perpendicular to X and R).
7. We are able only to notice the imaginary angle between Dimensional Times τ and τ'.
8. Notice that the observed relative velocity between $R\tau_1$ (intersection of R and τ_1) and $R\tau_2$ (intersection of R and τ_2) is

$$\tan(\alpha_{12}) = \frac{v_{12}}{c} = \tan(\alpha_1 + \alpha_2 - \theta) = \frac{\dfrac{\tan(\alpha_1)+\tan(\alpha_2)}{1+\tan(\alpha_1)\tan(\alpha_2)} - \tan(\theta)}{1 - \dfrac{\tan(\alpha_1)+\tan(\alpha_2)}{1+\tan(\alpha_1)\tan(\alpha_2)}\tan(\theta)} \quad \text{(A.1)}$$

Or

$$v_{12} = \frac{v_1 + v_2 - c\tan(\theta)(1+\dfrac{v_1 v_2}{c^2})}{1+\dfrac{v_1 v_2}{c^2} - \dfrac{\tan(\theta)}{c}(v_1+v_2)} \quad \text{(A.2)}$$

<u>Relativity fails for cosmological distances</u>. It is worth emphasizing that for $\tan(\theta)=1$ ($\theta=45^o$), independently upon the local velocities v_1 and v_2, the perceived velocity v_{12} is always -c.

$$v_{12} = \frac{v_1 + v_2 - c(1+\dfrac{v_1 v_2}{c^2})}{1+\dfrac{v_1 v_2}{c^2} - \dfrac{1}{c}(v_1+v_2)} = -c \quad \text{(A.3)}$$

Thus for $\theta=45^o$, anything at that cosmological angle will be rushing away at the speed of light.

Beyond that cosmological angle, relative time references and relative velocities are meaningless since there can not ever be communication or energy exchange between these two sites. There is a subtle difference between communication and travel and seeing the cosmological past, which has to do with the nature of light.

It is important to distinguish that the above derivation has to do with places one can travel or reach in terms of cosmological angles and not places one can see. One can see all the way to the beginning of times (with Doppler Shifted Vision – by upconverting the cosmic microwave background through fast traveling or other photonic means). The beginning of the Universe will always stare us in the eye, sitting at one radian or at the Beginning of Time. Gamma Radiation Doppler Shifted from the Big Bang is likely to be the pervasive Cosmic Microwave Background.

Definitions:

- Cosmological Time Φ represents an absolute time frame, as envisioned by Newton and Mach. It is a fifth dimension in the HU model.
- Radial Time R, is also a dimensional time or can be seen as a fourth spatial dimensional of propagation. It has a preferential direction (radial) and it defines a preferential time frame. Since one considers the Universe expansion velocity to be the speed of light, R keeps a simple relationship with Φ (identical module relationship).
- τ is any other propagation direction. This maps our local frame dimensional time and it is the source of the relativism in the Theory of Relativity. Different angles of propagation reflect different relative velocities.
- The angle between R and τ defines the local deformation of spacetime.
- The angle between τ' and τ defines the relative degree of local deformation of spacetime.
- Since the hypersurface is our three-dimensional Universe, a hypersuperficial spacetime wave is a spacetime disturbance that propagates along the Fabric of Space. The concept of the Fabric of Space will become clear as the theory is developed. Fabric of space is used in two manners: a) as the non-deformed spacetime, where local reference time τ points in the radial direction R and b) the subject of deformation.
- "Volumetric" waves are spacetime waves that are free to redirect themselves without having to deform the Fabric of Space. This will also become clearer as the theory is developed.

In this model, the Hyperspherical Universe is clearly finite, circular (radius of curvature equal to the dimensional age of the Universe, that is, the speed of light times the age of the Universe). It is also impossible to traverse, since it is expanding at the speed of light.

The R curvature is different from the curvature considered in General Relativity. That curvature is along τ. The R curvature is extremely well defined and it is equal to the reciprocal of the dimensional Age of the Universe. The other curvature can be modified by Mass distribution and controls redistribution of Mass around the shell Universe. Symmetry considerations would conclude that the average mass density of the Universe should be constant.

The figure also shows that the four-dimensional spacetime is curved, being the radius of curvature given by the dimensional age of the Universe. This simple figure eliminates the need for Cosmological Constant considerations about Gravitational collapse or anti-gravitational acceleration of the expansion of the three-dimensional Universe, since the Universe is proposed to be four-dimensional plus a Cosmological Time Φ.