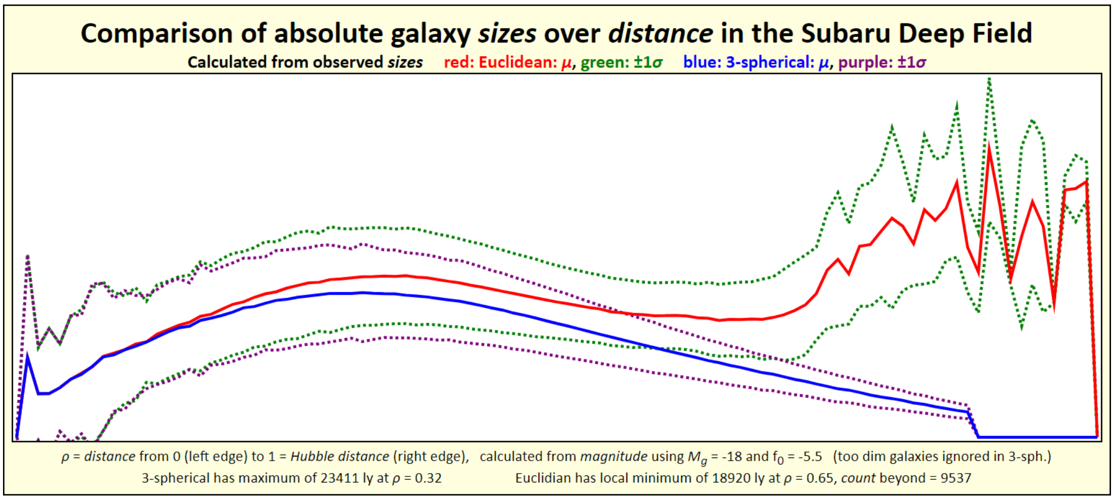
In my main treatise (http://henk-reints.nl/astro/HR-on-the-universe.php) I concluded the universe must be a 3-sphere, and then the *IniAll* must have been one as well. Eq.[244] gives its *hyperradius* as 1.632 au, and then the initial *Hubble distance* would have been $\pi \cdot 1.632 = 5.127$ au.

I also found the *absolute galaxy size* over *distance* of the Subaru Deep Field:



Comparison of absolute galaxy *sizes* over *distance* in the Subaru Deep Field

Calculated from observed *sizes* red: Euclidean: μ, green: $\pm 1\sigma$ blue: 3-spherical: μ, purple: $\pm 1\sigma$

ρ = *distance* from 0 (left edge) to 1 = *Hubble distance* (right edge), calculated from *magnitude* using M_g = -18 and f_0 = -5.5 (too dim galaxies ignored in 3-sph.)

3-spherical has maximum of 23411 ly at ρ = 0.32 Euclidian has local minimum of 18920 ly at ρ = 0.65, *count* beyond = 9537

A later analysis of the Hubble Ultra Deep Field yielded a similar image. From right to left, the blue curve shows the *absolute galaxy diameter* histogram $diam(\tau)$, with domain $[0,1]$, where τ is the dimensionless *time* since the big bang ("now" equals 1), calculated using 3-spherical geometry of the universe. Obviously there is a nearly perfectly linear *growth* over *time*, as measured in our own local frame. The cutoff for $\tau < 0.12$ is because the 3-sperically calculated *magnitude* over *distance* has a maximum at that point and I chose to use the lowest possible value of ρ, thereby mislocating approximately 7.6% of the galaxies. This last value is the percentage of quasars in SDSS:DR14Q that exceed this *distance*, based on their *redshifts*.

I found the HUDF catalog, which also contains *apparent diameters*, only after I wrote the other document, so its equivalent graph is not contained in there.

Both the SDF and the HUDF catalogs do not contain observed *redshifts*, and the photometric variant thereof is a redshifted herring.

I was hoping to find an initial galaxy *diameter* > 0 at $\tau = 0$ by a linear regression of the curve, which would then allow an estimate of the initial *Hubble distance*. Had it approximated the aforementioned value of say 5 au it would have been really nice, but alas. The linear extrapolation has its root after the big bang, even yielding a negative inital *Hubble distance*. That's of course impossible, but it clearly and firmly contradicts any inflationary phase of the universe, one of the many excogitations in standard cosmology.

I applied next algorithm:

1. at each value of τ take a segment of size 7 around it,
   discarding segments with $n < 7$ too near a domain boundary;
2. use only segments having $\frac{d}{d\tau} > 0$ at each of their points;
3. do a linear regression of each segment, yielding: $diam(\tau) = a_0 + a_1\tau$,
   and therefore: $diam\left(\tau = \frac{-a_0}{a_1} \equiv root\right) = 0$;
4. determine *means* and *standard deviations* of those a_0, a_1, and $root$ values over all segments;
5. discard all segments where either a_0, a_1, or $root$ is outside $\mu \pm s$;
6. of the remaining segments, take $root_0 = \mu(root)$ as well as $root_1 = \frac{-\mu(a_0)}{\mu(a_1)}$.

These $roots$ are an estimate of the *time* since the big bang when the extrapolated *galaxy diameter* would have been zero, and by extrapolating to "now" ($\tau = 1$) this regression yields a measure of the current *average galaxy diameter*. After conversion to true *time* using $t_H = 13.77$ Ga, the results are:

dataset	presumed *mean absolute galaxy magnitude*	presumed *attenuation coefficient* f_0	$root_0$	$root_1$	extrapolated current average *galaxy diameter*
HUDF (10 k objects)	-14.5	-5.5	448 Ma	469 Ma	109 kly
SDF (1.4 M objects)	-18.0	-5.5	448 Ma	498 Ma	37 kly

$$\mu(448{,}448{,}469{,}498) = 465.75\ \mathrm{Ma} \qquad \tau(465.75\ \mathrm{Ma}) = 3.38\%$$
$$\sigma(448{,}448{,}469{,}498) = 23.7\ \mathrm{Ma} \qquad \tau(448\ \mathrm{Ma}) = 3.25\%$$
$$s(448{,}448{,}469{,}498) = 20.5\ \mathrm{Ma} \qquad \tau(498\ \mathrm{Ma}) = 3.62\%$$

For the HUDF, I presumed a greater average *absolute magnitude* than for the SDF in order to place the maximum *count per distance* at $\frac{1}{2}D_H$. It is defendable that the HUDF, which is far smaller than the SDF, contains far less bright galaxies.

Please note both datasets yield the same (rounded) value of $root_0$. These results suggest the galaxy genesis started a bit earlier than half a million years after the big bang.

The quite large difference in the extrapolated current *diameter* may be due to the fact that the catalogs do not provide the same type of *apparent diameter*. From the HUDF catalog, I used the FWHM value, whilst the SDF catalogs give a profile RMS. The average of these extrapolated *diameters* equals 73 kly, which seems a reasonable value since very small galaxies are probably far too faint to appear in the images.

The galaxy catalog I extracted from the HyperLEDA database http://leda.univ-lyon1.fr is not representative for the entire universe. It contains 3.4 M objects, most of which are relatively nearby, but its *size per magnitude-based distance* histogram yields an over all average *absolute galaxy diameter* of 58 kly and its *size per redshift-based distance* histogram yields 110 kly. The SDF and HUDF catalogs do not contain observed *redshifts*.

The 3-spherical *quasar count* and *density* over *distance* based on *redshift* derived from SDSS:DR14Q (see http://henk-reints.nl/astro/HR-Geometry-of-the-Universe-v2b-20190729T0603Z.pdf) shows:

- most distant quasar: $z_{max} = 6.968 \triangleq \rho = 96.9\% \triangleq \tau = 3.1\% \triangleq 427\ \mathrm{Ma}$
- maximum *count* at: $\rho = 83\% \triangleq \tau = 17\% \triangleq 2341\ \mathrm{Ma}$
- maximum *density* at: $\rho = 84\% \triangleq \tau = 16\% \triangleq 2203\ \mathrm{Ma}$

The most distant quasar in SDSS:DR14Q coincides with $root_0 - s$, and I see the above maxima (average: 2.3 Ga) as the end of the quasar genesis, since from then on their *density* is nearly perfectly proportional to τ^{-3}.

The most distant galaxy known so far, GN-z11 (https://en.wikipedia.org/wiki/GN-z11) has a redshift of 11.09, so $\beta = \frac{(z+1)^2-1}{(z+1)^2+1} = 0.9864$ and therefore its *distance* equals $0.9864 \cdot 13.77 = 13.58\ \mathrm{Gly}$. This is definitely not its *light travel distance* (which WikipediA mentions as 13.4 (it probably uses FLRW which yields a smaller value), whilst it actually equals $\rho_L = \frac{\beta}{1+\beta} = 0.4966 \triangleq 6.838\ \mathrm{Gly}$), but it is its current *proper distance*. Please read http://henk-reints.nl/astro/HR-correct-Hubble-Lemaitre-law.pdf - there exists no horizon problem at all and the universe is definitely not larger than the *Hubble distance*. The 32 Gly as mentioned on WikipediA is a (I'm Dutch and we hardly use understatements) totally absurd value requiring *superluminality*, a phenome-none based excogitation that should be firmly rejected by every physicist. This value of β implies $\tau = 1.36\% \triangleq 187\ \mathrm{Ma}$ in *our* local frame. In its own frame however, it emitted the light we now observe when it was as old as our Milky Way galaxy is today (see http://henk-reints.nl/astro/HR-distant-proper-age.pdf). We do not observe a very young galaxy over there.

Since the galaxy size curve practically goes straight through zero at the moment of the big bang, it is very obvious there has never ever occurred any cosmic inflation as presumed by Alan Guth. This linearity also denies accelerated expansion of the universe.