What happened or existed before the big bang?

Well, what happens or exists north of the north pole?

Please note that *north of the north pole* is NOT the same as *above the north pole*. Of course there's air above it as well as other stuff, even a star (Polaris), but you won't get any further north by going upwards. So we'll stay on Earth's *surface*. *North of the north pole* means *at a latitude greater than* $90°$N *and closer to the axis of rotation than the north pole itself*, which is a meaningless concept since such *latitudes* don't exist and it would imply an absolute *distance* less than nought.

Let's first ask *when* the big bang occurred. That's an easy one. The *age* of the universe equals the reciprocal of the *Hubble constant*. I'll round the result to 14 Ga (the exact value is not relevant for this treatise).

In order to be able to say anything meaningful in response to the main question above, we'll first have a look at the **twin paradox** which was an attempt to disprove Einstein's Special ~~theory~~ conclusion of Relativity. Since truly identical twins (e.g. Jamie & Jamie) are a bit confusing, I'll name them Tyler and Sophia. *Sophia* means *wisdom* and I chose *Tyler* because it is at rank 97 in the 2019 top 100 of boy's names according to https://www.mom365.com/baby-names/top-boy-names?pageNumber=10 as of 2019-07-10, and 97 is the root mean square value of all two-digit primes between $\log_{1.005979943723382545}\left(\int_{-\infty}^{\infty} e^{-x^2} dx\right)$ and $-31.19436884601148582\pi i^2$ ☺. So we've got *Tyler time* and *Sophia time*.

At birth, Tyler and Sophia are separated, and Sophia starts a long travel at a high *velocity*, let's assume a *Lorentz factor* of $\gamma = 2$ (i.e. $v = \frac{c}{2}\sqrt{3} = 0.866c$), whilst Tyler stays at home. Then, as measured in *Tyler time*, *Sophia time* runs at half *speed* and when she returns after 20 years of *Tyler time* she is just 10 years old because she lives in *Sophia time*. So the 20 year old Tyler welcomes his 10 year old twin sister back home. But from Sophia's point of view, Tyler has been travelling all these 10 Sophia years at $\gamma = 2$, so as measured in *Sophia time*, *Tyler time* runs at half speed. Then the home coming 10 year old Sophia sees her 5 year old twin brother approach and welcome her. But he can't be both 20 and 5. That's the paradox.

The easy solution is: in order to be able to come home, Sophia must have turned around and that is a severe violation of Einstein's first postulate which restricts Special Relativity to constant *velocities*. How can you disprove a theory by violating its very first premise?

Then Einstein himself came with the difficult solution: General Relativity. For this turn-around, Sophia must have undergone a significant *deceleration* and *acceleration* and then *gravitational time dilation* causes the asymmetry.

But now suppose Tyler and Sophia are galaxies, both moving in the Hubble flow with a mutual *Lorentz factor* of say $\gamma = 2$. Galaxies definitely do not turn around and come back. All clocks in all galaxies have been synchronised to zero at the moment of the big bang, and please keep in mind that Special Relativity is not about differences in *light travel time*. In *Tyler time*, the *time* since the big bang equals 14 Ga according to all observations, which - according to the Cosmological Principle - is the same as seen from any galaxy, including our own Milky Way. But when a Tyler astronomer observes the Sophia galaxy having a *Lorentz factor* of $\gamma = 2$, he sees all Sophia clocks running at half *speed* due to *time dilation*, thus showing just 7 Ga. And vice versa this would be the very same. Is this a paradox or a contradiction? And if all Sophia clocks are indeed showing 7 Ga, then, as seen from the Sophia galaxy, all Tyler clocks must show just 3.5 Ga. But they show 14 Ga. This can't be solved using any gravitational effect caused by a turn around, since that doesn't happen.

So what is the actual *age* of the universe? Please think about this for a while before proceeding!

In the general relativistic solution of the twin paradox above, I (intendedly) focussed on Sophia's turning around in order to come back, and I ignored the *acceleration* during departure as well as the *deceleration* on return. But of course these are just as important.

In order to have achieved their *Hubble velocity,* galaxies must have undergone an *acceleration* as well. Presumably this occurred during the big bang. Once again, *gravitational time dilation* would solve the issue. How?

I'll use the term *Hubble extremity* for the far end of the *Hubble distance.* In a non closed geometry this would be the "edge of the universe", in a 3-spherical geometry it would be the antipodal point. It moves away from us at the *speed of light*, so we are moving away from it at the *speed of light*. From Einstein's *velocity* addition formula follows that addition of subluminal *velocities* always yields another subluminal *velocity*, which implies that the *velocity* between us and the *Hubble extremity* cannot have achieved this very *speed of light* in a finite *time*. And the *time* since the big bang has a finite value of 14 Ga. Oops.

This means the mutual velocity of any object and its *Hubble extremity* must have had an infinite *acceleration* in order to achieve the very *speed of light.* The finitude of the *speed of light* implies this infinite *acceleration* must have had a *duration* of zero.

The mutual *velocity* of the Tyler and Sophia galaxies relative to each other must then also have had an infinite *acceleration* during zero *time*, and then *gravitational time dilation* was infinite as well, resulting in an undetermined value, so the starting point of Sophia *time* may have been anywhere in Tyler *time* and vice versa. This means all clocks in the universe can easily show the same *age* of the universe.

This infinite *gravitational time dilation* also means that the zero big bang *duration* as observed in Tyler *time*, Sophia *time*, Milky Way *time*, or whatever galaxy's *time*, is dilated to a non-zero value for the big-banging *IniAll* itself (see http://henk-reints.nl/astro/HR-on-the-universe.php). In *IniAll time* it may even be infinite. Could that be true? A big bang since negative infinity?

Please have a look at the following. We define (and of course the suffix "us" refers to us):

the moment of the big bang:	$t_{bb,\mathrm{us}}$	measured in our *time,*
our "now":	$t_{0,\mathrm{us}}$	also in our *time,*
Then the *age* of the universe is:	$A_{U,\mathrm{us}} \equiv t_{0,\mathrm{us}} - t_{bb,\mathrm{us}}$	in our *time* as well.

Now consider an arbitrary distant galaxy which we'll call: "it". Overthere,

the big bang occurred at:	$t'_{bb,\mathrm{it}}$	measured in its *time*,
its "now" equals:	$t'_{0,\mathrm{it}}$	also in its *time*,
and of course they observe:	$A'_{U,\mathrm{it}} = t'_{0,\mathrm{it}} - t'_{bb,\mathrm{it}}$	in its *time* as well.

The prime indicates a value as observed in its *time*, without a prime a value is measured in our *time*.

The Cosmological Principle implies: $A^*_{U,*} = 14$ Ga, where the lower asterisk indicates it applies to each and every observer in the entire universe, and the upper one says it applies to each and every local *time* frame (which of course should be that observer's own *time* frame).

Then it is a universal truth that: $A_{U,\mathrm{us}} = A'_{U,\mathrm{it}} = A^*_{U,*}$

We see this galaxy move away from us at some *velocity* v_{it} in the Hubble flow, so, due to *time dilation*, we see its *time* go slower than our *time*, calculable via its *Lorentz factor* $\gamma_{\mathrm{it}} = 1/\sqrt{1 - v_{\mathrm{it}}^2/c^2}$.

Please note that *time dilation* is about *time* spans and not about moments in *time*. Applying the *Lorentz factor* to a point in *time* is a sort of IQ indicator... And it's also not about *light travel time*. Time dilation is due to *velocity*, not *distance*. So please imagine the very distant galaxy flying by at its very *Hubble velocity* in our very near neighbourhood where we can neglect the very small *light travel time*. Hmm, a very distant galaxy in our very near neighbourhood? Yes. It's only about its *velocity* with respect to us. In Special Relativity, *distance* doesn't matter at all. It's not used in any calculation.

Conversion of the *age* of the universe from its to our local *time* using the *Lorentz factor* yields: $A_{U,\mathrm{it}} = \gamma_{\mathrm{it}} A'_{U,\mathrm{it}}$

and then $t'_{bb,\mathrm{it}}$ occurred at: $t_{bb,\mathrm{it}} = t_{0,\mathrm{us}} - A_{U,\mathrm{it}} = t_{0,\mathrm{us}} - \gamma_{\mathrm{it}} A'_{U,\mathrm{it}}$

We've also got: $t_{0,\mathrm{us}} = t_{bb,\mathrm{us}} + A_{U,\mathrm{us}}$

which implies: $t_{bb,\mathrm{it}} = t_{bb,\mathrm{us}} + A_{U,\mathrm{us}} - \gamma_{\mathrm{it}} A'_{U,\mathrm{it}}$

Together with the universal truth: $A_{U,\mathrm{us}} = A'_{U,\mathrm{it}} = A^*_{U,*}$

we then obtain: $t_{bb,\mathrm{it}} = t_{bb,\mathrm{us}} + A^*_{U,*} - \gamma_{\mathrm{it}} A^*_{U,*}$

or: $t_{bb,\mathrm{it}} = t_{bb,\mathrm{us}} - (\gamma_{\mathrm{it}} - 1) A^*_{U,*}$

and because $\gamma_{\mathrm{it}} \geq 1$, this implies: $t_{bb,\mathrm{it}} \leq t_{bb,\mathrm{us}}$ (both are in our *time*)

YES: $\boldsymbol{t_{bb,\mathrm{it}} < t_{bb,\mathrm{us}}}$ **if** $\boldsymbol{\gamma_{\mathrm{it}} > 1}$

So its big bang moment occurred *before* our big bang moment as measured in our *time* which did not yet exist! That's wat happened before the big bang as observed by us. The *IniAll* already existed, as measured in its *time*, and it was already ejecting lumps of matter that became galaxies. But our *time* still had to start. We observe the whole series of events as if they occurred at a single point in our *time*. Time zero. And in our *time* we ourselves were the last piece of matter ejected by the *IniAll*. End of big bang.

It's more or less the reverse of what happens when you fall into a black hole. Your *time* will truly end, because you'll be terminated (you'll not be back...) and then your local frame has also ceased to exist. For a distant observer however, it'll take infinitely long in his *time* before he sees you hit it (please read http://henk-reints.nl/astro/HR-Black-Holes.pdf). And for the black hole itself it's just a single event at some point in its *time*. It will forever continue to exist and swallow incautious people like you.

Of course the same is valid for each and every observer in the universe. In his own *time* he himself was the very last object that was shot away from the exploding *IniAll*. The entire rest of the universe went before him. And the more distant another galaxy or whatever observer is, the greater its *velocity* according to the Hubble-Lemaître law, yielding a *Lorentz factor* that explodes towards infinity as the *distance* approaches the *Hubble distance*. The latter cannot imply anything else than that the big bang indeed lasted since negative infinity in its own *time*, and, as observed by us, we were the very last entity that was ejected by the big bang. The big bang did not happen at one single moment 14 Ga ago, but it ended by then. Yes, it's over. It lasted from negative infinity until 14 Ga ago. We're not able to observe anything of it because our own *time* just started at the very moment when the big bang was over. Can you truly remember anything from before you were born or even conceived? The only thing I remember is that there was nothing, nothing at all, and not even that. But does that mean there actually was nothing?

Compare this to the following. I build a completely new clock that starts ticking at zero when complete. Negative time does not exist for that clock, since it's brand new. You've built an identical clock yourself, and you're flying by with a *Lorentz factor* of say 10, which is easy to calculate with. Of course I'll hear your clock tick very slowly. I start watching your clock's display at the very moment my clock starts running, and in my first 10 seconds I see your clock slowly run from 9 to 10. So at my $t = 10$ it's also your $t' = 10$. Let's assume this $t = t' = 10$ occurs exactly at the event of our closest approach, which by chance happens exactly NOW. Then right now our clocks have the very same *age* of 10. My $t = 0$ was 10 seconds ago as measured in my *time*, but your $t' = 0$ occurred 10 seconds ago as measured in your *time*. But that's 100 seconds in my *time*, so your $t' = 0$ occurred 100 seconds ago in my *time*. Since NOW is at $t = 10$ as measured by me, your $t' = 0$ occurred at $10 - 100 = -90$ in my *time*. A negative result that in absolute value is 9 times larger than what my clock has ever ticked. So you built your clock at a moment in *time* that has never existed for me.

And now comes the difficult part: when synchronised at $t = t' = 10$ you'll see the very same when observing me. You built your clock before mine existed and I built mine before yours existed. Each measured in one's own *time*.

We can synchronise our clocks at only one single point in *time*, and at any other point in *time* an event cannot be simultaneous. That too is an aspect of Special Relativity. Disagreement about the simultaneity of events.

The same applies to the moment of the big bang. We observe and synchronise the entire universe right now. Then the big bang cannot ever have occurred simultaneously for all galaxies that are flying in the Hubble flow. But in each and every local frame it happened 14 Ga ago. So the universe just pretends to have an *age* of 14 Ga in any galaxy's local frame, whilst it's actually coming from negative infinity... It ended 14 Ga ago at the very moment when our *time* started at zero. All other objects went before us. Apart from us and our near neighbourhood, the entire universe already existed before it was our turn. But that's a sort of virtual reality because our *time* did not yet exist.

And this applies to each and every other observer, wherever in the universe, as measured in his/her own local frame. In every local frame the Hubble-Lemaître law will be observed, but since nobody can look further back in his own *time* than $A^*_{U,*}$, it'll yield a big bang at an apparent single point in *time*, i.e. their own $t^*_{bb,*}$.

Each object was abruptly ejected at its *Hubble velocity*. That is the discontinuity causing infinite *gravitational time dilation*. Our nought is dilated to negative infinity. The other way around it means the big bang's negative infinity was contracted to nought in every local *time*.

The *speed of light* is finite, but, as Einstein wrote, it plays the role of the infinite *velocities*. Infinity that manifests as a finitude. And now this seems to apply to the *age* of the universe as well.

So what existed before the big bang? The universe, except us.

For us and any other observer, this entire era has been contracted to nought in their own *time*.

And what happened before the big bang? The big bang itself.

Negative infinity.

Boredom.

HOWEVER...

After writing the above I became aware of a flaw.

See http://henk-reints.nl/astro/HR-distant-proper-age.pdf for details.

The big bang definitely did not look like any of these images. It was the entire universe itself, which cannot be viewed from outside, and the displayed background objects did not yet exist. An Englishman might call it rather silly, but I'm Dutch and we don't use understatements[1], so these images are utterly stupid fabrications by some ignorant moron.

It was observable from its inside only, and it looked like:

Not red hot but very intensely white hot all over.

Or even better: gamma ray hot.

(and of course it was not a rectangle...)

[1] Already back in the 16th century the Dutch were considered rude by people from other countries. But it's not meant to be offensive at all. We just say straight forward what you only dare thinking.