

Question 1:

Dear Cheap Astronomy – Just why?

Asking why the Universe is doesn't have to be a spiritual inquiry into purpose. We can look across the Universe and observe that things happen in very predictable patterns, following determinable and repeatable pathways of cause and effect which are always in the general direction of increasing entropy. The Universe is spreading out and hotspots of activity are cooling over time and it looks like this will just keep on happening until everything in the Universe eventually reaches a uniform temperature. So, there's clearly an inevitability built into the way things happen, but it's a stretch to call that purpose.

So leaving purpose to one side, the question we are grappling with in this episode is the issue of inevitability. Did the Big Bang happen because it's inevitable that something has to arise from nothing? But before we go there, we should consider whether it did it actually arise from nothing. Current, though very hypothetical thinking envisions a quantum vacuum, being a vacuum with no spacetime, but which is nonetheless bubbling with virtual particles that spring in and out of virtual existence. So while such a quantum vacuum is nothing – it's also a potential something, just waiting for the right trigger to become a real something. There's also some equally-fluffy thinking about gravity – which arguably could have an independent existence as a potential influencer, even though it only becomes an actual influencer in the presence of spacetime, mass and energy. So, perhaps, somehow the quantum vacuum and gravity interacted in a way that made the Big Bang happen. Well, maybe – and that's a very big maybe. It's easy to float a whole range of conceptual models which, in the absence of any data, can be neither confirmed or refuted.

What is worth grappling with is that prior to the Big Bang there was no spacetime. This isn't quite the same as saying there was nothing, but it does make questions about what happened before the Big Bang a bit meaningless. The Big Bang was the first event. There couldn't have been any preceding steps leading up to it since there was no time over which such steps could proceed, nor could there have been any separated ingredients that came together to make it happen since there was no space over which things could be either separated or come together.

Nonetheless, here we are, so clearly something happened. We can reasonably hypothesise there must be an underlying dimensionless foundation from which a Big Bang can arise, indeed such a foundation could underlie a multiverse of parallel Big Bang Universes – although you need to be careful not to envision a larger space within which those parallel universes sit. Anything outside of a spacetime universe can't also be spacetime, nor have the qualities of spacetime. There's a similar problem with the concept of sequential universes, where one universe is born expands and dies and then a new one takes off. This could only make sense if there was some kind of external timeline operating outside of those spacetime universes. It might be the case that a new Universe arises from the ashes of an old one, but if there is such a direct causal connection between them then they're not really separate Universes – it's just one phoenix universe.

But anyway, back to the question of why. It could be that a Big Bang Universe is an inevitable outcome of whatever underlying physics exists independent of that first spacetime event. Or it could just as well be that the Big Bang was an absurdly unlikely outcome of that underlying physics – which is kind of like saying for every event that happens there are a million and one non-events that don't happen. Either way the only data generated is that one event happened. So, inevitable? Well, the Universe did happen, so yeah, pretty-much.

Question 2:

Dear Cheap Astronomy – Will we ever make contact with aliens in another star system

Here at Cheap Astronomy, we don't think astronauts, taikonauts or any nauts will ever be exploring other worlds in person. There's nowhere we could go outside the Solar System within a lifetime and generation starships would just be a nightmarish Lord of the Flies in a tin can. Instead we'll send robots with 3d cameras so our grandkids can virtually explore. And there'll probably come a day when the robots cut the umbilical and just go off exploring themselves, self-replicating as they go, essentially becoming the next evolutionary step after us.

But way before then, the realization that we're never going to physically travel anywhere interstellar should be closely followed by the realization that no-one else is either, so all the stuff about it being too risky to let anyone know we're here in case they invade does seem a bit on the paranoid side. Most of Earth's resources are ubiquitous across the Universe and it's unlikely the planet we evolved on is going to be particularly habitable to alien species that evolved somewhere else – nor is likely such an alien species will want to eat us.

Indeed, given we haven't heard a peep out of anyone yet, it's conceivable that everyone else is also just starting out and also coming to the same realization that they'll probably never leave their own stellar system and hence may also be busy developing their own outbound robot progeny, while spending idle moments staring up at the stars and wondering if they're alone.

So someone's got to start the conversation and right now it looks like the ball's in our court. Our list of interstellar transmissions to date are:

A radio transmission of Morse code directed at Venus in 1962 – the whole exercise made no real sense and wasn't really interstellar but it is generally recognized the first.

Frank Drake's Arecibo message, which was transmitted to Messier 13 in 1974 and contained a depiction of DNA, human morphology and basic mathematics

Cosmic Call, 1999 and again in 2003 – a series of messages, with depictions of numbers and chemical elements and also Drakes message again directed

A Message from Earth 2008 was directed at exoplanet Gliese 581c and will get there in 2029 – after which it's another 21 years to receive a reply presuming the recipient has the right

equipment and inclination to answer straight back. This was full of photos, drawings and text messages from celebrities –which will at least look manufactured, even if it doesn't look intelligent.

In 2008 we transmitted the Beatles song Across the Universe to Polaris, which has no likelihood of habitable planets and is hundreds of light years away. We'd also sent some Theremin music to closer stars back in 2001 – just because we could.

In 2012, we sent replies to the Wow signal at some potential sources of it – again Twitter messages and celebrity video clips, but scientists did add on a repeating header signal – so it hopefully it looks both manufactured and a bit intelligent.

In 2013 there was the Lone signal, intended to be a continuous crowd-funded beacon funded by people who could send one free 144 character Twitter format message and then more longer messages and images at their cost, It was going to have a carrier signal with some scientific cleverness – but nuh. There was hubbub about drawing too much extraterrestrial attention to ourselves and not enough people subscribed anyway, so it never got off the ground.

Let's just say there were a few more music broadcasts, because... yep.

There is a genuine concern with SETI, the Search for Extraterrestrial Intelligence, that when we do finally isolate a clearly manufactured signal, the best minds on the planet will spend years analyzing its intricacies only to discover it's just some self-indulgent alien boondoggle. You reap what you sow.