Silence in the sky—but why?

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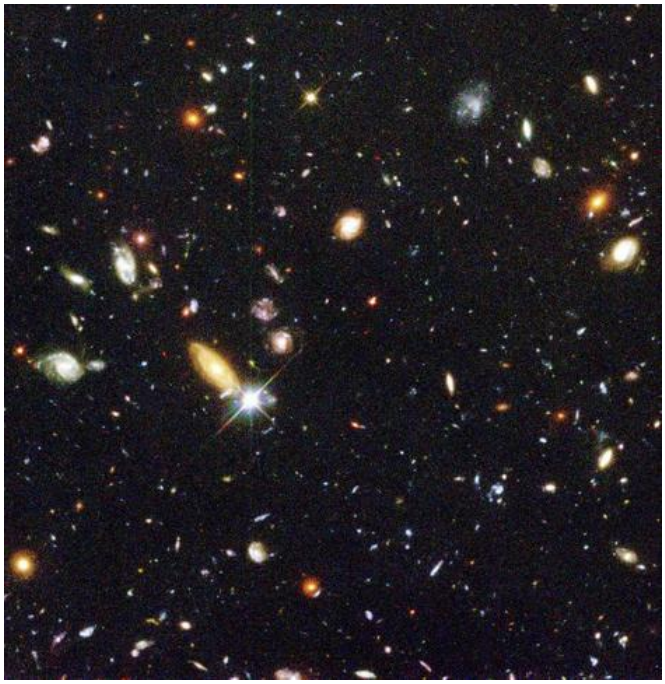

Hubble Deep Field image showing myriad galaxies dating back to the beginning of time. Image by Robert Williams and the Hubble Deep Field Team (STScI) and NASA.

(Phys.org) —Scientists as eminent as Stephen Hawking and Carl Sagan have long believed that humans will one day colonise the universe. But how easy would it be, why would we want to, and why haven't we seen any evidence of other life forms making their own bids for universal domination?

A new paper by Dr Stuart Armstrong and Dr Anders Sandberg from Oxford University's Future of Humanity Institute (FHI) attempts to answer these questions. To be published in the August/September edition of the journal *Acta Astronautica*, the paper takes as its starting point the Fermi paradox – the discrepancy between the likelihood of intelligent alien life existing and the absence of observational evidence for such an existence.

Dr Armstrong says: 'There are two ways of looking at our paper. The first is as a study of our future – humanity could at some point colonise the universe. The second relates to potential alien species – by showing the relative ease of crossing between galaxies, it makes the lack of evidence for other intelligent life even more puzzling. This worsens the Fermi paradox.'

The paradox, named after the physicist Enrico Fermi, is something of particular interest to the academics at the FHI – a multidisciplinary research unit that enables leading intellects to bring the tools of mathematics, philosophy and science to bear on big-picture questions about humanity and its prospects.

Dr Sandberg explains: 'Why would the FHI care about the Fermi paradox? Well, the silence in the sky is telling us something about the kind of intelligence in the universe. Space isn't full of little green men, and that could tell us a number of things about other intelligent life – it could be very rare, it could be hiding, or it could die out relatively easily. Of course it could also mean it doesn't exist. If humanity is alone in the universe then we have an enormous moral responsibility. As the only intelligence, or perhaps the only conscious minds, we could decide the fate of the entire universe.'

According to Dr Armstrong, one possible explanation for the Fermi paradox is that life destroys itself before it can spread. 'That would mean we are at a higher risk than we might have thought,' he says. 'That's a concern for the future of humanity.'

Dr Sandberg adds: 'Almost any answer to the Fermi paradox gives rise to something uncomfortable. There is also the theory that a lot of planets are at roughly at the same stage – what we call synchronised – in terms of their ability to explore the universe, but personally I don't think that's likely.'

As Dr Armstrong points out, there are Earth-like

planets much older than the Earth – in fact most of them are, in many cases by billions of years.

Dr Sandberg says: 'In the early 1990s we thought that perhaps there weren't many planets out there, but now we know that the universe is teeming with planets. We have more planets than we would ever have expected.'

The *Acta Astronautica* paper looks at just how far and wide a civilisation like humanity could theoretically spread across the universe. Past studies of the Fermi paradox have mainly looked at spreading inside the Milky Way. However, this paper looks at more ambitious expansion.

Dr Sandberg says: 'If we wanted to go to a really remote galaxy to colonise one of these planets, under normal circumstances we would have to send rockets able to decelerate on arrival. But with the universe constantly expanding, the galaxies are moving further and further away, which makes the calculations rather tricky. What we did in the paper was combine a number of mathematical and physical tools to address this issue.'

Dr Armstrong and Dr Sandberg show in the paper that, given certain technological assumptions (such as advanced automation or basic artificial intelligence, capable of self-replication), it would be feasible to construct a Dyson sphere, which would capture the energy of the sun and power a wave of intergalactic colonisation. The process could be initiated on a surprisingly short timescale.

But why would a civilisation want to expand its horizons to other galaxies? Dr Armstrong says: 'One reason for expansion could be that a sub-group wants to do it because it is being oppressed or it is ideologically committed to expansion. In that case you have the problem of the central civilisation, which may want to prevent this type of expansion. The best way of doing that get there first. Pre-emption is perhaps the best reason for expansion.'

Dr Sandberg adds: 'Say a race of slimy space aliens wants to turn the universe into parking lots or advertising space – other species might want to stop that. There could be lots of good reasons for any species to want to expand, even if they don't actually care about colonising or owning the universe.'

He concludes: 'Our key point is that if any civilisation anywhere in the past had wanted to expand, they would have been able to reach an enormous portion of the universe. That makes the Fermi question tougher – by a factor of billions. If intelligent life is rare, it needs to be much rarer than just one civilisation per galaxy. If advanced civilisations all refrain from colonising, this trend must be so strong that not a single one across billions of galaxies and billions of years chose to do it. And so on.

'We still don't know what the answer is, but we know it's more radical than previously expected.'

More information: *Acta Astronautica* paper: www.sciencedirect.com/science/ … ii/S0094576513001148

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