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Earth’s full, go home

How the fact there are aliens on Earth is telling us either we are the first intelligence to arise or some unknown factor prevents the evolution of space-faring civilisations

Sometimes I think we are alone, sometimes I think we are not. Either way, the thought is staggering.

Buckminster Fuller

I'm sure the Universe is full of intelligent life. It's just been too intelligent to come here.

Arthur C. Clarke

One striking feature of the world is so obvious that, like the darkness of the sky at night, it is almost never remarked upon. It does not matter what country you live in, what continent you are on, where at all you are on the planet. There are no aliens. They are not loitering on street corners, coasting angelically through the clouds above your head or materialising and de-materialising like crew members of the "Star Trek" Enterprise*.*

The fact there are no aliens on Earth is widely believed to be telling us something profound about intelligent life in the Universe. Unlike the case with the other everyday observations in his book, however, no one is quite sure what that profound thing is.

Over the years, many people have realised that the lack of aliens on Earth is a deep puzzle. However, the person who articulated it in the most memorable way was the Italian physicist Enrico Fermi. One of the last physicists to combine the roles of front-rank theorist and an experimentalist, not only did Fermi come up with a theory of radioactive beta decay, which

predicted the existence of the ghost-like "neutrino, but he constructed the first nuclear reactor - on an abandoned squash court under the west stand of the University of Chicago's Stagg Field. Fermi's "nuclear pile", which went "critical" on 2 December 1942, made the "plutonium" for one of the two atomic bombs dropped by America are on Japan. Those bombs were tested in the desert of New Mexico. And it was, while visiting the bomb lab at Los Alamos in the summer of 1950, that Fermi made his memorable observation about extraterrestrials.

He was having lunch in the canteen with Herbert York, Emil Konopinski and Edward Teller, the "father of the H-bomb". The physicists had been discussing ETs because of a recent spate of newspaper reports of "flying saucers". Although the discussion had turned to more mundane subjects, Fermi had gone quiet, deep in thought. Suddenly, in the middle of the ensuing conversation, he blurted out: "*Where is everybody?*" The others around the table immediately knew what he was referring to - ETs. They also recognised that Fermi, a man with a reputation as a deep thinker, had articulated something important and profound.

Fermi was a renowned for his back-of-the envelope calculations. For instance, at the explosion of the first atomic bomb at Alamogordo in the New Mexico desert on 15 July 1945, he had dropped a scrap of paper from shoulder height and watched how it was deflected by the shock wave from the Bomb. Knowing that Ground Zero was 9 miles away, he estimated the energy of the blast – the equivalent of more than 10,000 tonnes of TNT.

Implicit in Fermi's "Where is everybody?" question was a similar back-of-the-envelope calculation. How long it would take a civilisation that developed a star-faring capability to spread to every star system in our Milky Way galaxy?

Fermi never revealed the details of his reasoning. However, more likely than not he realised that the most efficient way to explore the Galaxy would be by means of self-reproducing space probes. Such a probe, on arrival at a destination planetary system, would set about constructing two copies of itself from the raw materials found there. The two daughter probes would then fly off and, at the next planetary system, build two more copies. In this way, the probes would infect the Galaxy relatively rapidly like bacteria spreading throughout a host.

Using plausible estimates for the speed of such probes and the time required to make copies, it was possible to estimate how long it would take to visit every star in the Milky Way. And the answer was surprisingly modest – between a few million and a few tens of millions of years. Since this was a mere fraction of the 10 billion-year lifespan of our Galaxy, one conclusion was unavoidable. If a star-faring race had arisen at any time in the history of our Galaxy, its space probes should be here on Earth today. So, in Fermi's immortal words, "*Where is everybody?*'