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The lonely life of a double planet

We could be alone in the Galaxy because the Earth and the Moon make up a unique double planet. Rare, giant moons such as ours may be necessary for the emergence of life

Jerome Pearson

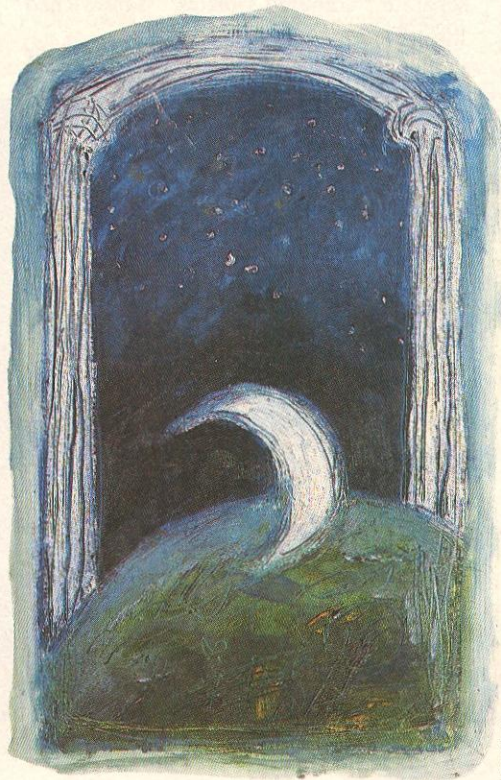
“WHERE ARE the extraterrestrials? Why haven't they landed in their flying saucers on the White House lawn to welcome humanity to the Galactic Club?” Enrico Fermi asked this most pertinent question back in 1939, long before the search for extraterrestrial intelligence (SETI) began. In the past few decades, Fermi's question has taken on a new urgency as we have built powerful radio receivers and listened to tens of thousands of ever-silent stars, and even sent our own planned and unplanned signals to unresponding planets.

Fermi's paradox arises from a chain of apparently sound logic, observations, and assumptions. The Milky Way is a pinwheel disc of stars, gas and dust about 100 000 light years across, rotating once every 200 million years. There are billions of stars in the Milky Way that are very much like the Sun, warm and long-lived. Many millions of these stars may be accompanied by planets, and thousands or even millions of the planets may be suitable for life. If life arises naturally, then we might expect thousands of living planets and perhaps hundreds of civilisations in our Galaxy.

In the 1960s, Frank Drake, who was working at the National Radio Astronomy Observatory, West Virginia, created an equation to estimate the number of civilisations in the Galaxy. This was based on reasonable guesses about the proportion of suitable stars and planets, and the probability that life, intelligence and civilisation would develop. Any seemingly consistent set of numbers in Drake's equation predicts a multitude of life in the Galaxy. Our Galaxy is between 10 and 15 billion years old, so if there are civilisations, some of them should be much older than ours. Travelling a mere 1 per cent of the speed of light, their spaceships could have covered the entire Galaxy in a few million years. Yet an ever-expanding SETI program has found no evidence of any intelligence. There are no signs that they visited us, are on the way, or even that they are communicating among their many settled worlds. Fermi's paradox has become more of a mystery than ever.

What are the possible answers? Over the past decade, many scientists have considered the possibilities. Those who believe in the quest for extraterrestrial intelligence, led by Carl Sagan of Cornell University, imagine that interstellar travel is difficult or impossible, that spreading civilisation is a slow and painful process, and that societies destroy themselves before they can reach us. This leaves us with the possibility of using radio to communicate with isolated societies on other planets.

Other scientists, such as Anthony Martin and Alan Bond of the Culham Laboratory, the United Kingdom Atomic Energy Authority's centre for fusion research near Oxford, see the lack of extraterrestrials as proof that we are alone in the Galaxy, if not in the Universe. Many of these scientists use



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biology to argue that the occurrence of life by chance is so remote as to be unthinkable. Other scientists believe that evolution is such a random walk that no two intelligent species developing on different planets could have enough in common even to recognise each other, much less to communicate intelligently.

Perched somewhat precariously are those who deny the very existence of the Fermi paradox and insist that the Galaxy is teeming with life, just as Drake's equation predicts, and that extraterrestrials have visited us. They have not revealed themselves because they are studying us. An interstellar civilisation could know all there is to know about stars, planets and solar systems. The only unpredictable thing that could arouse their scientific curiosity would be the extraordinary variety of alien life forms, and therefore they have set us aside in a "zoo" (or "asylum") for observation.

The time is ripe for a fresh look at these contradictory theories. Something is wrong either with our assumptions or with our logic. One basic assumption is that of ordinariness. We assume that the Earth and its life are typical, placed in a moderate location in a typical solar system around an average star. Yet the Earth is not typical at all—it is unique in our own Solar System, for several reasons.

The most obvious point is that the Earth and its Moon are more like a double planet than a primary and its satellite. The Moon is far larger compared with the Earth than any other satellite of a major planet in the Solar System. Our Moon is so large that it does not actually go around the Earth at all; its orbit is always concave toward the Sun. Jupiter and Saturn have 317 and 95 times the mass of the Earth, respectively. Even so, their largest moons are hardly bigger than our Moon. Only Pluto and Charon represent another such pair, and they are so small that they are more of a double asteroid than a major planet and its moon. They may be the remnants of an escaped moon of Neptune ruptured by the violent upheaval that tore it from that planet. Alternatively, they may be part of a second asteroid belt that shades into the distant, giant Oort Clouds of comets orbiting far beyond Neptune. Our large Moon has affected the Earth significantly. The ocean tides raised by the Moon had a profound effect on the evolution of crustaceans and amphibians. The emergence of tidewater zones, which alternate between flooding and drying out, perhaps even helped life to emerge on land.

A second anomaly is the presence of Earth's atmosphere and oceans, which are unique in the Solar System. The amount of oxygen in the Earth's atmosphere is far too much for chemical equilibrium. This unstable condition is maintained by the constant action of living plants; without life, the oxygen would react with the materials on the surface and produce carbon dioxide. The excess carbon is tied up in enormous beds of limestone and rocks containing other