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BOOK REVIEW

The Great Silence: Science and Philosophy of Fermi's Paradox by Milan M. Ćirković. Oxford, UK: Oxford University Press, 2018. 395 pp. $33.95 (hardcover). ISBN 978-019-9646-30-2.

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SETI, the Search for Extraterrestrial Intelligence, used to seem to be the cutting edge of available mystery. The Milky Way galaxy is immense, perhaps 400 billion stars, and the entire visible universe holds perhaps hundreds of billions of similar galaxies. If life on Earth is a product of evolution, there must be billions of billions of worlds inhabited by creatures ranging from bacteria to intelligent, conscious, alien people, all distinct in form but converging on civilizations capable of listening for radio evidence of others near or preposterously far in space and time, and peppering the heavens with their own messages. If they are there, some nearby will have been able to pick up a century and more of electronic signals tearing out from our world at the speed of light.

Yet we hear not the faintest answer, no trace of them Out There. Why? *Where are they?* asked Nobelist Enrico Fermi in 1950, lunching with colleagues, toying with the mid-century hysteria over flying saucers. If our understanding of science is correct, "they" *must* be there, in profusion if not in UFOs. With this confidence in mind, SETI was established 35 years ago, nearly half a human lifetime, to listen and look for them. After the intervening decades, though, with ever-improving equipment, we still do not detect them. It's a paradox! It's "Fermi's Paradox."

A Serbian astrobiophysicist and astronomer, Milan M. Ćirković, Ph.D., is a research professor at the Astronomical Observatory of Belgrade and a research associate of the Future of Humanity Institute at Oxford University On the evidence of this remarkable book, he is an ingenious polymath who shows little patience with SETI researchers who (he claims) fail to keep up with new data, displaying a kind of privileged narrow vision, or perhaps self-protection, in clinging to defunct theories of galaxies and their improbably absent inhabitants. Again, then: *Where are they?*

In 2015, Stephen Webb published an updated edition of his 2006 lucid if simplified book on this topic, *Where is Everybody? Seventy-Five Solutions to the Fermi Paradox and the Problem of Extraterrestrial Life*

(Webb, 2015). His tally of feasible solutions ranged from the obvious—life is extremely rare, it gets snuffed out wherever conscious beings discover nuclear weapons and other devices of mass extinction, all the aliens are terrified of Berserker death machines so they shut down every sign of their existence—to more arcane ways and motives to be hidden. Ćirković acknowledges Webb's efforts but trims his own taxonomic framework down to four general classes of explanation, each class showing family resemblances in certain distinct ways.

These are: Solipsist Hypotheses; Rare-Earth Hypotheses; Neo-catastrophic Hypotheses; and Logistic Hypotheses. Each of the 36 individual hypotheses discussed is given an often whimsical name, and a rather subjective grade, from A to F. Nine of them earn a Failing F, while only one gets as high as an A-minus (the "Gaian Window," in which "only a few Earth-like planets can develop a stable biotic feedback," constrained by "stellar, atmospheric, and tectonic evolution" that creates "narrow, near-lethal bottlenecks"). Some of these fairly distinct reasons for *not* witnessing such civilizations include many where there ought to be demonstrable "manifestations and artefacts." One such is a Dyson swarm, where much of a planetary system is broken apart and repurposed to spin around its sun, capturing as an energy source much of the radiated solar energy.

In terms of hiding from far observers, though, this turns out to be a fairly decisive Fail. An improved version devised by the late, brilliant Robert Bradbury, a collaborator with Dr. Ćirković, is dubbed the Matrioshka Brain, shell within shell within shell, each consecutively drawing on the waste heat dribbled in from the shells closer to the star. The outermost shell would be almost undetectable from galactic space. (Bradbury's astonishing speculations featured in my anthology *Year Million* [Broderick, 2008].)

Perhaps the most radical attempted explanation, *The New Cosmogony*, borrows from the brilliant Polish writer Stanislaw Lem (1983):

> Very early cosmic civilizations ("the Players;" billions of years older than humanity) have advanced so much that their artefacts and their very existence are indistinguishable from "natural" processes observed in the universe. Their information processing is distributed in the environment on so low a level that we perceive it as operations of the laws of physics. Their long-term plans include manipulation of these very laws in order to create new stages of cosmological evolution. Since the whole of the observable reality is, thus, partly artificial, there is no Fermi's paradox. (p. 134)

The philosophical aspect of the book's analysis investigates conventional elements dubious and otherwise. Typical of these are philosophical naturalism (nothing preternatural or superscientific, please),

scientific realism (airports and quarks are real, unicorns and UFOs aren't), Copernicanism (we humans are typical, the galactic average, so ignore all those planets producing intelligence in the billions of years before life began on Earth), gradualism (ignore those immense catastrophic punctuations in equilibrium), and the non-exclusivity principle (diversity will prevail unless something enforces Fermi uniformity on a galactic scale). Much of the book is a swift ballet around these difficult problematics.

Ćirković provides a table, trimmed below, in recapitulation of his detailed discussions of attempts to resolve the Fermi conundrum. Some headings are self-evident (the "Zoo Hypothesis" suggests we are somehow shut out of the rest of the universe, perhaps for our protection, by aliens with vastly superior technology), while some are less so ("Galactic Stomachache" seriously posits that universal utopian lazy ease, lacking any stress, will end by destroying such cultures).

SOLIPSIST HYPOTHESES

1. Fermi's Flying Saucers
2. Ancient Flying Saucers
3. Special Creation
4. Zoo Hypothesis
5. Interdict Hypothesis
6. Leaky Interdict
7. Planetarium Hypothesis
8. Peer Hypothesis
9. Simulation Hypothesis
10. The Paranoid Style in Galactic Politics
11. Directed Panspermia
12. Bit-String Invaders
13. **New Cosmogony**

RARE-EARTH HYPOTHESES

14. Early Great Filter
15. Horizon to the Rescue
16. Gaian Window
17. Permanence
18. Thoughtfood Exhaustion

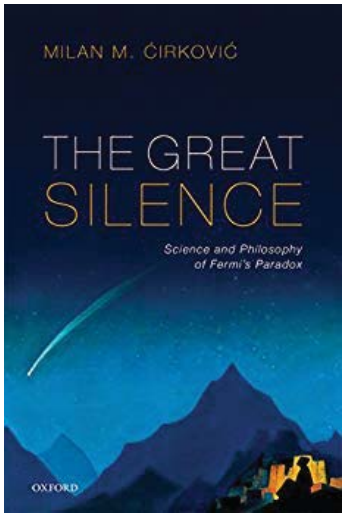
NEOCATASTROPHIC HYPOTHESES

19. The Gigayear of Living Dangerously
20. Astrobiological Phase Transition
21. Stop Worrying and Love the Bomb
22. Self-Destruction, Advanced Version

23. Introvert Big Brother
24. Resource Exhaustion
25. Deadly Probes
26. Interstellar Containment
27. Transcendence (General)
28. Transcension Hypothesis

LOGISTIC HYPOTHESES

29. Red Empire
30. Brown Empire
31. Persistence
32. Living on the Rim
33. Eternal Wanderers
34. Great Old Ones
35. Sustainability
36. Galactic Stomachache



Of these, I favor the Transcension account (although the New Cosmogony has its appeal). Here, progression of both organic and machine people converge almost inevitably on a kind of transcendental (but non-religious) condition of connectivity, perhaps beyond spacetime as quantum theory and general relativity currently model our testable universe. I admit that my preference for this exotic history is reflected in the title and storyline of my 2002 novel *Transcension* (Broderick, 2002), not mentioned by Ćirković.

If runaway technology keeps heading with exponential speed up the ever-rising curve of the Singularity without necessarily ascending into a transcendent state, one might expect that our solar system and others will eventually become what is known as Kardashev civilizations. These were characterized in 1964 by the quantity of energy they can extract safely from their suns (Kardashev, 1964). Type 1 lays hold of all of a world's spare output, channeling it into (for example) hypercomputation. Type 2 will mobilize *all* the untapped energy of its star, perhaps using a Dyson or Matrioshka surround. Type 3, beyond the grasp of a human mind, would gain and control the resources of an entire galaxy. If a Type 4 can be conceived, it might corral the entire free energy of the cosmos.

In any event, Type 2 can be analyzed and taken seriously for a highly advanced civilized culture, leaving traces of its astroengineering for us to observe if we look for the right sort of evidence. Nikolai Kardashev pointed out brusquely in 1985, just as SETI was founded: "Extraterrestrial civilizations have not yet been found, because in effect they have not yet been searched for" (Kardashev, 1985:497). Ćirković notes that this

complaint still has considerable force, despite the wealth of information newly available during the last twenty years and especially the last five. For example, it turns out that the optimum place for a sophisticated and powerful culture to reside might be the cold, dim, outer edge of a galaxy. By contrast, SETI looks mostly for Earth-like worlds in a privileged habitable zone of its star, and evidently (if Ćirković is correct) is disdainful of the "sci-fi" suggestions pointing in other directions.

For this bracing attitude, and others, *The Great Silence* abounds in both well-selected and up-to-date information as well as inventive, insightful analyses of the many suggested explanations for that Silence, as it was dubbed by the astronomer and science fiction writer (G.) David Brin in 1983 (Brin, 1983:283) (and acknowledged for its excellence by Dr. Ćirković). Despite the density of the argument, and some occasional minor skirmishes with the English language, this is a marvelous book. One can only hope that the mavens at SETI and related bio and astro specialists will pay the argument its due.

—**Damien Broderick**
thespike@satx.rr.com

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