

Bookshelf

COMPILED BY VIRGINIA GRECO, CERN

Strange Glow: The Story of Radiation

By Timothy J Jorgensen

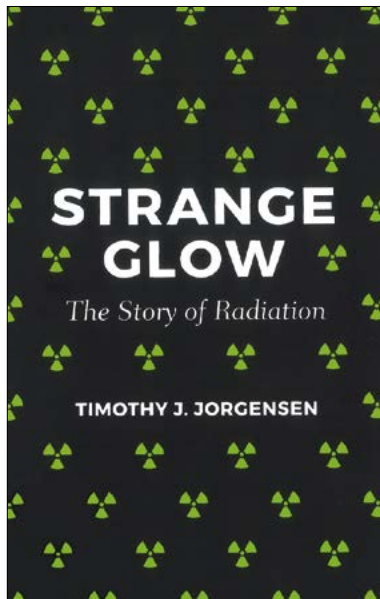
Princeton University Press

In this book, Timothy Jorgensen, a professor of radiation medicine at Georgetown University in the US, recounts the story of the discovery of radioactivity and how mankind has been transformed by it, with the aim of sweeping away some of the mystery and misunderstanding that surrounds radiation.

The book is structured in three parts. The first is devoted to the discovery of ionising radiation in the late 19th century and its rapid application, notably in the field of medical imaging. The author establishes a vivid parallel with the discovery and exploitation of radio waves, a non-ionising counterpart of higher energy X rays. A dynamic narrative, peppered with personal anecdotes by key actors, succeeds in transmitting the decisive scientific and societal impact of radiation and related discoveries. The interleaving of the history of the discovery with aspects of the lives of inspirational figures such as Ernest Rutherford and Enrico Fermi is certainly very relevant, attractive and illustrative.

In the second part, the author focuses on the impact of ionising radiation on human health, mostly through occupational exposure in different working sectors. A strong focus is on the case of the “radium girls” – female factory workers who were poisoned by radiation from painting watch dials with self-luminous paint. This section also depicts the progress in radiation-protection techniques and the challenges related to quantifying the effects of radiation and establishing limits for the exposure to it. The text succeeds in outlining the difficulties of linking physical quantities of radiation with its impact on human health.

The risk assessment related to radiation exposure and its impact on human health is further covered in the third part of the book. Here, Jorgensen aims to provide quantitative tools for the public to be able to evaluate the benefits and risks associated with radiation exposure. Despite his effort to offer a combination of complementary statistical approaches, readers are left with an impression that many aspects of the impact of radiation on human health are not fully understood. On the contrary, the large number of radiation-exposure cases in the Hiroshima and Nagasaki nuclear bombings, after which it was possible to correlate the absorbed dose with the location of the



various victims at the time of the explosion, provides a scientifically valuable sample to study both deterministic and stochastic effects of radiation on human health.

In part three, the book also digresses at length about the role of nuclear weapons in the US defence and geopolitical strategy. This topic seems somewhat misplaced with respect to the more technical and scientific content of the rest of the text. Moreover, it is highly US-centric, often neglecting the analogous role of such weapons in other countries.

It is noteworthy that the book does not cover radiation in space and its crucial impact on human spaceflight. Likewise, the discovery of cosmic radiation through Hess' balloon experiment in 1911–1912, while constituting an essential finding in addition to the already discovered radioactivity from elements on the Earth's surface, is completely overlooked.

Despite the lack of space-radiation coverage and the somewhat uncorrelated US defence considerations, this book is definitely a very good read that will satisfy the reader's curiosity and interest with respect to radiation and its impact on humans. In addition, it provides insight into the more general progress of physics, especially in the first half of the 19th century, in a highly dynamic and entertaining manner.

● Rubén García Alía, CERN.

The Great Silence – The Science and Philosophy of Fermi's Paradox

By Milan Cirkovic

Oxford University Press

Enrico Fermi formulated his eponymous paradox during a casual lunchtime chat with colleagues in Los Alamos: the great physicist argued that, probabilistically, intelligent extraterrestrial lifeforms had time to develop countless times in the Milky Way, and even to travel across our galaxy multiple times; but if so, where are they?

The author of this book, Milan Cirkovic, claims that, with the wealth of scientific knowledge accumulated in the many decades since then, the paradox is now even more severe. Space travel is not speculative anymore, and we know that planetary systems are common – including Earth-like planets – suggesting that life on our planet started very early and that our solar system is a relative late-comer on the cosmic scene; hence, we should expect many civilisations to have evolved way beyond our current stage. Given the huge numbers involved, Cirkovic remarks, the paradox would not even be completely solved by the discovery of another civilisation: we would still have to figure out where all others are!

The Great Silence aims at an exhaustive review of the solutions proposed to this paradox in the literature (where “literature” is to be understood in the broadest sense, ranging from scholarly astrobiology papers to popular-science essays to science-fiction novels), following a rigorous taxonomic approach. Cirkovic's taxonomy is built from the analysis of which philosophical assumptions create the paradox in the first place. Relaxing the assumptions of realism, Copernicanism, and gradualism leads, respectively, to the families of solutions that Cirkovic labels “solipsist”, “rare Earth”, and “neocatastrophic”. His fourth and most heterogeneous category of solutions, labelled “logistic”, arises from considering possible universal limitations of physical, economic or metabolic nature.

The book starts by setting a rigorous foundation for discussion, summarising the scientific knowledge and dissecting the philosophical assumptions. Cirkovic does not seem interested in captivating the reader from the start: the preface and the first three chapters are definitely scholarly in their intentions, and assume that the reader already knows a great deal about Fermi's paradox. As a particularly egregious example, Kardashev's speculative classification of civilisations, based on the scale of their energy consumption, plays a

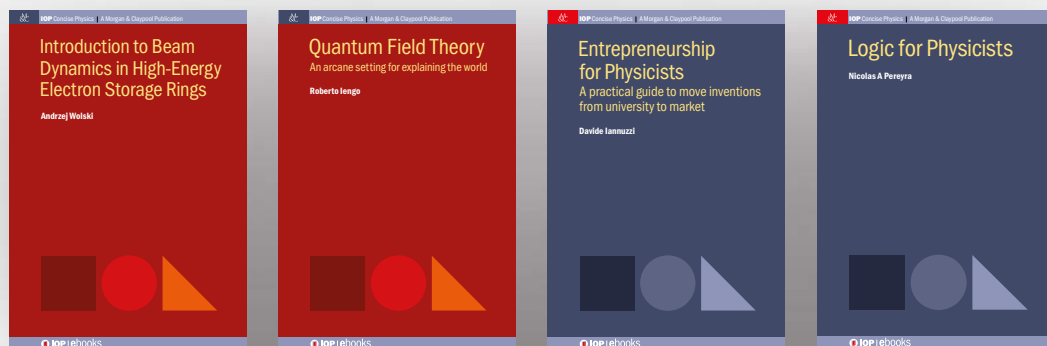
Discover these and more – download the first chapter of every title for free.

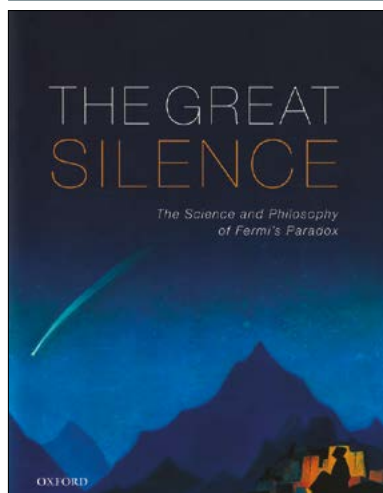
iopscience.org/books

Expanding Physics™



Concise Physics™





very important role in this book; one would have therefore expected a discussion about that, somewhere at the beginning. Instead, the interested reader has to resort to a footnote for a succinct definition of the three types of civilisation (Type I: exploiting planetary resources; Type II: using stellar system resources; Type III: using galactic resources).

However, after these introductory chapters, Cirkovic's writing becomes very pleasant and engaging, and his reasoning unfolds clearly. Chapters four to seven are the core of the book, each of them devoted to the solutions allowed by negating one assumption. Every chapter starts with an analogy with a masterpiece in cinema or literature, followed by a rigorous philosophical definition. Then, the consequent solutions to Fermi's paradox are reviewed and, finally, a résumé of take-home messages is provided.

This parade of solutions gives a strange feeling: each of them sounds either crazy, or incredibly unlikely, or insufficient to solve the paradox (at least in isolation). Still, once we accept Cirkovic's premise that Fermi's paradox means that some deeply rooted assumption cannot be valid, we are compelled to take seriously some outlandish hypothesis. The reader is invited to ponder, for example, how the solution to the paradox might depend on the politics of the Milky Way in the last few billion years: extraterrestrial civilisations may have all converged to a Paranoid Style in Galactic Politics, or we might unknowingly be under the jurisdiction of an Introvert Big Brother (Cirkovic has a talent for catchy titles). Some Great Old Ones might be temporarily asleep, or we (and any conceivable biological intelligence) might be limited in our evolution by some Galactic Stomach-Ache. A large class of very gloomy hypotheses assumes that

all our predecessors were wiped out before reaching very high Kardashev's scores, and Cirkovic seems particularly fond of the idea of swarms of Deadly Probes that may still be roaming around, ready to point at us as soon as they notice our loudness. Unless we reach the aforementioned state of galactic paranoia, which makes for a very nice synergy between two distinct solutions of the paradox.

The author not only classifies the proposed solutions, but also rates them by how fully they would solve this paradox. The concluding chapter elaborates on several philosophical challenges posed by Fermi's paradox, in particular to Copernicanism, and on the link between it and the future of humanity.

Cirkovic is a vocal (and almost aggressive) critic of most of the SETI-related literature, claiming that it relies on excessive assumptions which strongly limits SETI searches. In his words, the failure of SETI so far has mostly occurred on philosophical and methodological levels. He quotes Kardashev in saying that extraterrestrial civilisations have not been found because they have not really been searched for. Hence Cirkovic's insistence on a generalisation of targets and search methods.

An underlying theme in this book is the relevance of philosophy for the advancement of science, in particular when a science is in its infancy, as he argues to be the case for astrobiology. Cirkovic draws an analogy with early 20th century cosmology, including a similitude between Fermi's and Olmert's paradoxes (the latter being: how can the night sky be dark, if we are reachable by the light of an infinite number of stars in an infinitely old universe?).

I warmly recommend *The Great Silence* to any curious reader, in spite of its apparent disinterest for a broad readership. In it, Cirkovic makes a convincing case that Fermi's paradox is a fabulously complex and rich intellectual problem.

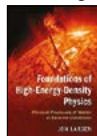
● *Andrea Giammanco, UCLouvain, Louvain-la-Neuve, Belgium.*

Books received

Foundations of High-Energy-Density Physics: Physical Processes of Matter at Extreme Conditions

By Jon Larsen

Cambridge University Press



This book provides a comprehensive overview of high-energy-density physics (HEDP), which concerns the dynamics of matter at extreme temperatures and densities.

Such matter is present in stars, active galaxies and planetary interiors, while on Earth it is not found in normal conditions, but only in the explosion of nuclear weapons

and in laboratories using high-powered lasers or pulsed-power machines.

After introducing, in the first three chapters, many fundamental physics concepts necessary to the understanding of the rest of the book, the author delves into the subject, covering many key aspects: gas dynamics, ionisation, the equation-of-state description, hydrodynamics, thermal energy transport, radiative transfer and electromagnetic wave-material interactions.

The author is an expert in radiation-hydrodynamics simulations and is known for developing the HYADES code, which is largely used among the HEDP community. This book can be a resource for research scientists and graduate students in physics and astrophysics.

Quantized Detector Networks: The Theory of Observation

By George Jaroszkiewicz

Cambridge University Press



Quantised Detector Networks (QDN) theory was invented to reduce the level of metaphysics in the application of quantum mechanics (QM), moving the focus from the system

under observation to the observer and the measurement apparatuses. This approach is based on the consideration that "labstates", i.e. the states of the system we use for observing, are the only things we can actually deal with, while we have no means to prove that the objects under study "exist" independently of observers or observations.

In this view, QM is not a theory describing objects *per se*, but a theory of entitlement, which means that it provides physicists with a set of rules defining what an observer is entitled to say in any particular context.

The book is organized in four parts: Basics, Applications, Prospects, and Appendices. The author provides, first of all, the formalism of QDN and then applies it to a number of experiments that show how it differs from standard quantum formalism. In the third part, the prospects for future applications of QDN are discussed, as well as the possibility of constructing a generalised theory of observation. Finally, the appendices collect collateral material referred to at various places in the book.

The aim of the author is to push the readers to look in a different way at the world they live in, to show them the cognitive traps caused by realism – i.e. the assumption that what we observe has an existence independent of our observation – and alerting them that various speculative concepts and theories discussed by some scientists do not actually have empirical basis. In other words, they cannot be experimentally tested.