

LIGHT OF THE STARS: ALIEN WORLDS
AND THE FATE OF THE EARTH

by Adam Frank,
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SUMMARY: The article presents a review of the book: *Light of the Stars: Alien Worlds and the Fate of the Earth* by Adam Frank, published by W.W. Norton, New York, 2018, hardcover, 272 pp., illus. ISBN 978-0-393-60901-1 (the Serbian edition: *Svetlost zvezda: tuđinski svetovi i sudbina Zemlje*, Adam Frenk, translated by Milan Peric, McMillan, Beograd, 2018, paperback, 248 pp, illus. ISBN: 978-8680328102).

Science has its showrooms and its workshops. The public to-day, I think rightly, is not content to wander round the showrooms where the tested products are exhibited; the demand is to see what is going on in the workshops.

Arthur S. Eddington (1933)

The great American philosopher, poet, educator, and an early eco-activist Ralph Waldo Emerson happened to be in Paris during the tumultuous days of the 1848 liberal revolutions across Europe. Upon arrival, on the Champ de Mars he saw the stumps of trees that had been cut down to form street barricades. Subsequently, he wrote in his journal a memorable sentence: “At the end of the year we shall take account, and see if the Revolution was worth the trees.”

These wise words apply not only to political upheavals, but to intellectual and scientific revolutions. Adam Frank’s new book, *Light of the*

Stars, reminds us time and again that we are living in the dramatic period of astrobiological revolution (roughly 1995-today). This is a unique book, which escapes conventional classifications; although it formally belongs to popular science, it contains some quite advanced discussions and at least one major philosophical argument which has been hitherto unknown or ignored. Thus, it should properly belong to an “intermediate” category, similar to well-known titles like Sir Roger Penrose’s *Emperor’s New Mind* or Steven Jay Gould’s *Wonderful Life* or many books by Richard Dawkins. It is not the style or the approach, though, which makes Frank’s book truly unique—it is, first and foremost, the ground it covers. In particular, it gives the first serious attempt to present *astrobiology of the Anthropocene* in a format accessible to an educated layperson. There has been some ground-breaking research literature on the subject in recent years which the interested reader can find in Frank’s bibliography or at the end of this review,¹ but nothing remotely comparable in terms of breadth and accessibility.

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¹In particular, see Baum (2010); Frank and Sullivan (2014); Lin, Gonzalez Abad, and Loeb (2014); Stevens, Forgan, and James (2016).

The astrobiological revolution has obtained, it is by now obvious, an additional dimension of emerging *synthesis* of knowledge. Formally speaking, the very facts that new institutions of research and higher education with “astrobiology” in their titles are founded, and that new journals like *Astrobiology* and *International Journal of Astrobiology* have emerged as important research outlets, testify that it is a recognized bona fide scientific endeavour. And the fact that even quite traditionally oriented evolutionists, Earth scientists, biochemists, astronomers or computer scientists more and more often list astrobiological interests or astrobiological applications of their results, give support to the claims of synthesis. In addition, the great potential of astrobiology in the domain of popularization of science and public outreach, as well as science education and the continuous education.

So, why would anyone doubt that astrobiological revolution is “worth the trees” in Emerson’s dramatic phrase? Well, obviously because in light of some recent developments in the world, in particular the recent ascent of populism, primitivism, nationalism, religious fundamentalism, and other anti-Enlightenment attitudes, the question whether *homo sapiens* and its culture are adult enough to face the true planetary and cosmic challenges. Because we are living in the Anthropocene as a unit of time, although there is no consensus yet on its exact beginning. The Anthropocene brings with it not only an unprecedented evolutionary novelty – a civilization capable of modified its physical environment on the planetary scale – but also risks and danger never encountered in about 4 billion years of our biosphere’s existence. Even the most extreme outcome – the possibility that our species goes extinct before it truly understands the place of life and mind in the cosmic order of things – seems to be quite realistic possibility. Global climate change, the loss of biodiversity, the danger of a nuclear war and the consequent nuclear winter, misuse of biotechnology or nanotechnology for warfare or terrorism, and finally, the ultimate “phantom menace” of an artificial (super)intelligence – all these risks add together to cause the Anthropocene to be the most dangerous interval of time in the history of our species, and presumably the planetary biosphere as well. There is no rhetorical manoeuvre, no amount of paternalist propaganda, no appeal to mysticism or religion, which could mitigate this disturbing conclusion.

Which is exactly why Frank’s book has not only cognitive, but quite practical value as well. That ambition is never obscured. Already on its early pages, we can glimpse a key passage which, correctly understood and interpreted, justifies the claim of this book for epochal importance (pp. 12-13):

We all want our project of civilization to continue deep into the Anthropocene. But our efforts so far have mostly failed. We’ve known about global warming, the most obvious symptom of the emerging Anthropocene, for more than fifty years. Despite having that

knowledge, we’ve done almost nothing to deal with climate change and its consequences. Our politics, our economics, and even our moral philosophy have all failed to drive actions that could ensure the long-term sustainability of our project on a changing planet.

The failure is rooted in the mistaken view that we, and our project are a one-time story. But we can be forgiven for that failure because, until very recently, we didn’t have the tools or the information to rise above the one-time story. We did not yet have the astrobiological perspective. But now we do, and it can change the path to our future.

This book explores what might be called the astrobiology of the Anthropocene, and it’s built out of two braided questions.

- *What can the revolutions of astrobiology tell us about life on other worlds, even other intelligences and their civilizations?*

- *What can life on other worlds, even other intelligences and their civilizations, tell us about our own fate?*

This passage is quoted at length, since it contains the essence of the enterprise undertaken by the author, who is an astrophysicist and astrobiologist at the University of Rochester (Rochester, NY): to offer an accessible outline of a new and exciting way of thinking emerging from the ongoing research. The *astrobiology of the Anthropocene* is not just a mere combination of the two fashionable words; instead, it is an organic whole containing much more than the sum of its parts. Such enrichment and cross-fertilization of two scientific disciplines does happen often in modern science, but the parts simply have not had such an inherent value and generality so far.

There are some good – and, rarely, brilliant – books on astrobiology; the same, to a lesser degree, applies to the Anthropocene (although two concepts are almost contemporary, the latter has been immensely more politicized, which is practically a warrant for the decreased average quality). Obviously, there will be many more on both topics in the future. However, there has been no book dealing fully with the emerging synthesis of the two domains – or at least the has been none prior to the publication of Frank’s book. There have been several mentions of the synthesis, either in passing (since the focus was on different issues) or restraining from logical conclusions which have dramatic consequences on both cognitive and practical level. There was no full-length, clear-eyed treatment – until now and until *Light of the Stars*.

Now, about the key philosophical point which serves as an underpinning of Frank’s claims. There has been an unhealthy tendency in much of the astrobiology and SETI studies to label various approaches to foundational question according to their relationship to the existence of extraterres-

trial life/intelligence. Thus, classical pluralists like William Herschel, and modern researchers like Carl Sagan, Iosif Shklovsky, Frank Drake, Jill Tarter, or Charles Cockell have usually been labeled as “believers” (in the extraterrestrial life/intelligence). Their opponents, people like William Whewell, Alfred Russel Wallace, George G. Simpson, Frank Tipler, or Peter Ward are, consequently, labelled or often self-labelled “sceptics” (on the issue of extraterrestrial life/intelligence).² However, this is just one way of parsing the matter. As I have proposed elsewhere in more detail (Ćirković 2012, esp. chapters 5 and 6), it would be actually more in the Copernican spirit to use the opposite deciding point: how special or not is the Earth, its biosphere and its intelligent beings? Under this relabeling, the SETI founding fathers should be denoted as “sceptics” (about the uniqueness of Earth), while the rare-Earth theorists would obviously be dubbed “believers” (in the uniqueness of our planet). This is not just the wordplay or a question of literary style, very far from it. In fact, this is perhaps the very central, foundational philosophical issue at the heart of almost all disputes – and as such it is practically never explicated. To a large degree, this reflects the extra-scientific dominance of anti-Copernican thinking, which includes the rejection not only of the fruitfulness of searching for life and intelligence elsewhere in the universe, but *the rejection of the very idea that such activity can ever be serious and respectable part of science*. Media, influencing to a large degree public opinion in the matter, are firmly entrenched in anti-Copernicanism, as are other human societal, legal, and political institutions.

In science, of course, it is quite different story and it needs no particular effort to show to any scientific audience how crucial and immensely fruitful has Copernicanism been in origination and progress of science since 1543. There has actually been no philosophical assumption, except for the baseline scientific realism implicit in the very endeavor, which has been even remotely important in the course of the success story of modern science, since the Renaissance to this very day and for the foreseeable future. Clearly, there is a wide rift between scientific and general audiences on this point, and it could be argued that this basic philosophical rift is what creates or fuels many controversies to this day, from debates on global climate change, to the resistance to recognizing moral rights of animals, to the resurgent religious fundamentalism, creationism, and “intelligent” design, to the scandalous superficiality and naivete with which serious risks associated with artificial intelligence are still treated in most circles. Half-jokingly (but only half!), one may conjecture that if Galileo’s trial before the Roman Inquisition were to be held today, more humans – and in particular strong majority of journalists, lawyers, politicians and taxi-drivers

– would support or root for the Inquisition, rather than the father of physical science.

Such a situation calls for much more work in the field of popular science, in particular in fields in which Copernicanism meets its ideological opponents. And that occurs in both poles of the axis spanned by *Light of the Stars*: both in astrobiology and in studies of the Anthropocene. While it is more obvious in the domain of the Anthropocene, it happens in astrobiology all of the time. Frank clearly identifies such situations and valiantly combats waves of anti-Copernican prejudice. He clearly sees the basic dilemma in terms of the relabelling described above – the existence of Earth with its complex biosphere and technological civilization indicates such things are perfectly compatible with the laws of nature (i.e., the true laws, not the incomplete laws we humans know today!), and Copernicanism asserts that we should not, as long as we lack detailed empirical evidence, assume that such a state is special or untypical. This is repeated time and again in the *Light of the Stars*; unfortunately, even some reviewers who should be knowing better have not grasped it, charging Frank – and astrobiology in general – for perceived “arrogance”.³

This follows from a widespread philosophical confusion (or even illiteracy) as far as epistemology and philosophy of science goes. The Copernican point is both very basic and incredibly important – but unfortunately has been obscured by insistent and intentional confusion and obfuscation for many decades, if not centuries, post-Copernicus and most certainly post-Darwin. Therefore, it is worth a somewhat detailed digression to elaborate.

Suppose I peek through a window and say: “It is raining.” How is my statement to be interpreted? In particular, how is that statement to be interpreted by a listener which has essentially the same understanding of concepts, but does not necessarily share the *specific* context of my observation? First, the understanding of the concept of “rain” leads to the naturalistic account of the phenomenon I am talking about: the listener and I agree that rain is a natural phenomenon, in general well explained by the laws of physics. However, the explanation does not necessarily lead to exact prediction, since the well-known dependence of weather on small uncertainties in boundary conditions causes limited validity of any predictive model. The fact that I could not be certain yesterday that it would indeed rain today, does not in itself cast even a smallest doubt on the naturalist account of rain as a phenomenon. Even if weather forecast were much worse than it actually is, I would have absolutely no reason to doubt that rain is a natural phenomenon and it would be utterly irrational to endorse any non-naturalist account of it (e.g., similar to that adhered to by our shamanist forefathers who believed in the “spirit of rain” or a similar supernatural entity).

²Even worse in terms of generating confusion are the “optimist” and “pessimist” labels, which include value judgements of moral philosophy; we cannot go into this topic here.

³A perfect example in this sense is the review of Jeff Foust in *Space News* (at <http://www.thespacereview.com/article/3522/1>, last accessed December 18, 2018).

The naturalist account of rain is, however, just a small part of the interpretation of my statement “It is raining.” The very fact that I observe rain seemingly suggest that rain is not in itself an excessively rare phenomenon. Now, this is not *necessarily* true, but it is still overwhelmingly probable on any account of probability. If the prior probability density of rain were of the order of 10^{-100} per year, it would be much likelier that I am mistaken, and that it is not in fact raining.⁴ In that case, we would be justified in suspecting some random firing of neurons which caused me to hallucinate the rain. Hallucination would be a *better explanation* of the observation.

On the other hand, once the listener knows – from having perhaps some independent insight into atmospheric physics – that rain is not some excessively improbable exotic phenomenon, there is no particular reason to suspect my statement to be a product of random error or hallucination. Even then, there are implications of obvious importance which are usually ignored but which have substantial impact on the debate of uniqueness (or not) of life in the universe. How about spatiotemporal position? If it is raining at my position, do I need to take an umbrella to work? On one hand, the work is at different location in space and I will be there at a different point in time. On the other hand, we know from experience (i.e., an informal inductive inference) that it is highly probable – although again not *necessarily* true – that it will rain at the other end of town in half an hour or so. So, there is a spatiotemporal spread or smear-out of the natural phenomenon of rain. Ultimately, it boils down to *implicit* characteristic spatial and temporal *scales* of physical processes underlying the observed phenomenon: things like vapor condensation, formation of pressure and moisture gradients, etc. We do not need to understand details of the latter to be quite confident about grabbing an umbrella. And even if we get it wrong once or twice, and it does not in fact rain on the other side of town, such occurrences do not make our decision irrational. On the contrary, it would be irrational to leave the umbrella in hope of a small, local spatiotemporal spread of the raining clouds.

What does all of this have in common with the debate on uniqueness of our Earth? Clearly, any *scientific* account of abiogenesis has to treat life in the same qualitative manner as our scientific account of rain treats rain: it is a natural phenomenon; it is a phenomenon to be explained though not necessarily predicted in a naturalistic manner; it is not excessively improbable; it has a spatiotemporal spread – and it is only rational to assume all that in absence of specific empirical evidence to the contrary. And it is rational in spite of occasional failures of prediction, which are bound to happen from time to time.

Of course, it is possible to deny Copernicanism and stick to the guns of anthropocentrism. The newest incarnation of this pathway has been dubbed the “rare Earth” hypothesis, after the eponymous bestseller of Peter Ward and Donald Brownlee ap-

pearing at the turn of the century/millennium (Ward and Brownlee 2000). There is a great deal of controversy surrounding the rare Earth hypothesis, we cannot go into here. What is important is that there is no compelling reason to accept the uniqueness claim of the anti-Copernicans. If anything, the tide has turned in the last years, when many of the original rare-Earth predictions (e.g., that most of extrasolar planets are “hot Jupiters”) have been falsified.

Frank’s book is solidly on the Copernican side of the story. In fact, this Copernicanism is the crucial link between astrobiology and the Anthropocene. He emphasizes that the basic conclusion that other habitable planets are essentially large-scale natural “experiments” which can tell us about Earth’s future, as well as the past, hinges on the implied Copernicanism. The only thing one can regret is that Frank’s treatment of this issue is too short – although this might be due to an editor, rather than the author.

Frank’s book has another added value, appropriate for concluding this review: although well-grounded in our best scientific insights, it is deeply and sincerely optimistic. And this is what is needed by both scientific and lay audiences. Forty years ago, in the legendary *First Three Minutes*, Steven Weinberg famously proclaimed that “the more the universe seems comprehensible, the more it also seems pointless.” The proclamation caused a furore and a cascade of charges against science as allegedly cold, unsympathetic, soulless, and inhumane. New-Age sects and postmodernist quasi-philosophers received quite a boost from such a perspective. In the present book, however, Adam Frank demonstrates how the Weinbergian pessimism is just one side of the coin. The other one is exactly practical optimism which follows the modern insights of astrobiology, indicating that life is more widespread cosmic phenomenon than we have thought hitherto. It perhaps pertains to the intelligent life as well.

On the other hand, it does not endorse determinism. The fate of intelligence on Earth is, fortunately or not, still just in our hands. In order to be even remotely competent to decide upon this fate, it is necessary that we all, scientists, decision-makers, and lay public alike, are well-informed on the relevant themes of astrobiology and the Anthropocene. Adam Frank’s book is an important step in the right direction.

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⁴I could have lived in a desert, but there is no desert *that* dry; if there were, such location would have been atypical in the truly cosmological sense and certainly incompatible with my existence as an observer. I leave aside here the complex issue of the so-called Boltzmann brains (e.g., Carlip 2007).

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