



Existential Physics:
A Scientist's Guide to Life's Biggest Questions
by Sabine Hossenfelder (Autor)

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What I like about the book is it is honest! In the preface Sabine Hossenfelder puts “her cards on the table”:

“I want you to know what you are getting yourself into, so let me put my cards on the table up front. I am both agnostic and a heathen. I have never been part of an organized religion and never felt the desire to join one. Still, I am not opposed to religious belief. Science has limits, and yet humanity has always sought meaning beyond those limits. Some do it by studying holy scripture, some meditate, some dig philosophy, some smoke funny things. That’s all fine with me, really. Provided that—and here’s the crux—*your search for meaning respects scientific fact.*” ...

...and she continues to do so throughout the book – letting others promote their theories but she doesn’t hold back her own opinion.

As an engineering-educated, interested layman in fundamental physics I also liked her concise, understandable interpretations of definitions within the realm of physics, like initial states, systems, emergent theories, evolution of theories, multiverses etc., without much scientific gobbledygook. For example, explaining increasing entropy as mixing “highly ordered” ingredients like flour, sugar and eggs into a “high entropy” smooth batter, is strikingly memorable.

Addressing the “big” (existential) questions like how we originated, where we are going, was our existence created or did it develop at random, i.e., are we only a ‘bag of atoms’, or ‘a brain in a jar’, are not new, but “this book is also about the big questions that modern physics raises, from the question whether the present moment differs from the past, to the idea that each elementary particle may contain a universe, to the worry that the laws of nature determine our decisions. What she wants to tell us is, how much scientists currently know, and also where science crosses over into mere speculation. Her way of tackling those questions is appealing and refreshing, according to her statement at the beginning of the book that fundamental physics wants to *generate knowledge*.

You might get lost in Hossenfelder’s detailed fundamental argumentations but at the end of each chapter she summarizes her conclusion in a “short answer”, you might or might not agree with. Sabine Hossenfelder gives you enough leeway to come to your own conclusions but also feels free to admit that a better result simply is not known (yet) or will never be known.

As an example I would like to present her “short answer” to chapter 6 “Has Physics ruled out Free Will?": After an in depth and thorough explanation of the different philosophical and scientific approaches covering historical and current theories on 14 intellectually challenging pages of the book, Hossenfelder sums it up as: “According to the currently established laws of nature, the future is

determined by the past, except for occasional *quantum events* that we cannot influence. Whether you take that to mean that free will does not exist depends on your definition of free will”

Under the headline “Other Voices: Is consciousness computable?”, Hossenfelder included an interview with Roger Penrose about consciousness, and as a personal aside, in this interview Penrose kind of formulates my own speculation that our universe and everything in it can’t just be random. Penrose answered after being asked whether he would be religious: “Do I believe in a god?” Roger asks himself. “No, not in the usual sense of the word.” Hossenfelder insists by asking: “Do you believe that the universe has a purpose?” sensing he wants to add something. “You’re getting close . . . ,” Roger says hesitantly. “I don’t know if the universe has a purpose, but I would say that there is something more to it, in the sense that the presence of conscious beings is probably something deeper, not just not random.

The following quotations from the book reflect Sabine Hossenfelder’s (S.H.) opinion:

S.H. on predicting human behavior or brain simulation

So far it seems we have no reason to think human behavior is un-computable, that human decisions are algorithmically undecidable, or that human behavior might be predictable for only a finite amount of time. Especially in light of the neuron-replacement argument from chapter 4, it full well looks as though we can simulate brains on a computer and therefore predict human behavior. However, the human brain may not be the best thinking apparatus, but it has distinct advantages over all machines we have built so far: It functions for decades.

S.H. on artificial intelligence (AI)

Personally, I have little doubt that an artificial general intelligence is possible. It may become a great benefit for human civilization—or a great problem. It is certainly important to think about what ethics to code into such intelligent machines. But the most immediate problems we will have with AIs will come from our ethics, not theirs.

Sabine Hossenfelder closes with: “Most of this book is discussing what physics teaches us about our own existence. Hopefully you’ve enjoyed the tour, but maybe you sometimes couldn’t avoid the impression that this is heady stuff that doesn’t do much to solve problems in the real world. And so, as we near the end of this book, I want to spend a few pages on the practical consequences that understanding unpredictability may have in the future (...).

I liked Hossenfelder’s book very much, because it shows the current status and explains limits of fundamental physics in terms of “in principle ...if we would have all initial conditions of the system, infinite computing memory, quantum fluctuation, unpredictability, singularity, mathematical limitation by running into infinity or, we simply don’t know.’

In the book Hossenfelder also quotes and discusses many other non-standard theories about the pre-big bang and other theories like multiverses, creation of a mini universe in the lab and about the fate of our universe etc., acknowledging they have their merits, however dismissing them as non-scientific because there are no observable data - thus not falsifiable, failing scientific standards.

Or to quote her from the epilogue: “Most hypotheses for the early universe, for example, are just complicated stories that are unnecessary to describe anything we observe. The same goes for attempts to find out why the constants of nature are what they are, or theories that introduce unobservable parallel universes. This isn’t science. It’s religion masquerading as science under the guise of mathematics. Don’t get me wrong. I don’t have a problem with people pursuing these ideas per se. If someone finds it valuable for whatever reason, that’s fine with me—everyone should be free to

exercise their religion. But I want scientists to be mindful of the limits of their discipline. Sometimes the only scientific answer we can give is, *we don't know*".

As Sabine Hossenfelder states in the beginning, *the primary product of foundations of physics is [to provide/generate] knowledge*.

This book indeed increased my personal scientific knowledge and the consciousness for its limitations.

The book is highly recommended for everyone who wants to stay abreast with the "big questions"

To paraphrase Sabine Hossenfelder – try it, but it is not easy.

May 2023, Joachim J. Kehr, Editor Journal of Space Operations & Communicator
<https://opsjournal.org>