

Essay

## Why I Still Like String Theory

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### Abstract

Why I Still Like String Theory? The main one is that it solves the problem of how quantum theory looks in the perturbative limit about a flat space-time with gravitons interacting with matter. The second one is that it supports a holographic principle that is also required for quantum gravity. The third one is that it would match well with TeV scale SUSY, but the LHC might have now ruled that out. Further, it predicts a multiverse of vacua in the right quantities required to explain anthropic reasoning for an unnatural fine-tuned particle theory.

**Key Words:** string theory, quantum gravity, holographic principle, SUSY, anthropic reasoning.

There is a new book coming up by Richard Dawid “String Theory and the Scientific Method. It has been reviewed by [Peter Woit](#) and [Lubos Motl](#) who give their expected opposing views. Apparently Woit gets it through a university library subscription. I can’t really review the book because at £60 it is a bit too expensive. Compare this with the [recent book by Lee Smolin](#) which I did review after paying £12.80 for it. These two books would have exactly the same set of potential readers but Smolin is just better known which puts his work into a different category where a different type of publisher accepts it. I don’t really understand why any author would choose to allow publication at a £60 price-tag. They will sell very few copies and get very little back in royalties, especially if most universities have free access. Why not publish a print-on-demand version which would be cheaper? Even the Kindle version of this book is £42 but you can easily self publish on Kindle for much less and keep 70% of profits through Amazon.

My view is equally predictable as anyone else’s since I have previously explained why [I like String Theory](#). Of the four reasons I gave previously the main one is that it solves the problem of how quantum theory looks in the perturbative limit about a flat space-time with gravitons interacting with matter. This limit really should exist for any theory of quantum gravity and it is the realm that is most like familiar physics so it is very significant that string theory works there when no other theory does. OK, so perturbative string theory is not fully sewn up but it works better than anything else. The next best thing is supergravity which is just an effective theory for superstrings.

My second like is that String Theory supports a holographic principle that is also required for quantum gravity. This is a much weaker reason because (a) it is in less well known territory of physics and requires a longer series of assumptions and deductions to get there (b) It is not so obvious that other theories won’t also support the holographic principle.

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Reason number three has not fared so well. I said I liked string theory because it would match well with TeV scale SUSY, but the LHC has now all but ruled that out. It is possible that SUSY will appear in LHC run 2 at 13 TeV or later, or that it is just out of reach, but already we know that the Higgs mass in the standard model is fine-tuned. There is no stop or Higgsino where they would be needed to control the Higgs mass. The only question now is how much fine-tuning is there?

This brings me to my fourth reason for liking string theory. It predicts a multiverse of vacua in the right quantities required to explain anthropic reasoning for an unnatural fine-tuned particle theory. So my last two reasons were really a hedge. The more evidence there is against SUSY, the more evidence there is in favour of the multiverse and the string theory landscape.

Although I don't have the book I know from Woit and Motl that Dawid provides three main reasons for supporting string theory that he gathered from string theorists. None of my four reasons are included. His first reason is "The No Alternatives Argument", apparently we do string theory because despite its shortcomings there is nothing else that works. As Lee Smolin pointed out over at NEW, there are alternatives. LQG may succeed but to do so it must give a low energy perturbation theory with gravitons or explain why things work differently. Other alternatives mentioned by Smolin are more like toy models but I would add higher spin gravity as another idea that may be more interesting. Really though I don't see these as alternatives. The "alternatives theory view" is a social construct that came out of in-fighting between physicists. There is only one right theory of quantum gravity and if more than one idea seems to have good features without them meeting at a point where they can be shown to be irreconcilable then the best view is that they might all be telling us something important about the final answer. For those who have not seen it I still stand by my satirical video on this subject:

[A Double Take on the String Wars](#)

Dawid's second reason is "The Unexpected Explanatory Coherence Argument." This means that the maths of string theory works surprisingly well and matches physical requirements in places where it could easily have fallen down. It is a good argument but I would prefer to cite specific cases such as holography.

The third and final reason Dawid gives is "The Meta-Inductive Argument". I think what he is pointing out here is that the standard model succeeded because it was based on consistency arguments such as renormalisability which reduced the possible models to just one basic idea that worked. The same is true for string theory so we are on firm ground. Again I think this is more of a meta-argument and I prefer to cite specific instances of consistency.

The biggest area of contention centres on the role of the multiverse. I see it as a positive reason to like string theory. Woit argues that it cannot be used to make predictions so it is unscientific which means string theory has failed. I think Motl is (like many string theorists) reluctant to accept the multiverse and prefers that the standard model will fall out of string theory in a unique way. I would also have preferred that 15 years ago but I think the evidence is increasingly favouring high levels of fine-tuning so the multiverse is a necessity. We have to accept what appears to be right, not what we prefer. I have been learning to love it.

I don't know how Dawid defines the scientific method. It goes back many centuries and has been refined in different ways by different philosophers. It is clear that if a theory is shown to be inconsistent, either because it has a logical fault or because it makes a prediction that is wrong, then the theory has to be thrown out. What happens if a theory is eventually found to be uniquely consistent with all known observations but its characteristic predictions are all beyond technical means. Is that theory wrong or right? Mach said that the theory of atoms was wrong because we could never observe them. It turned out that we could observe them but what if we couldn't for practical reasons? It seems to me that there are useful things a philosopher could say about such questions and to be fair to Dawid he has articles freely available on line that address this question, e.g. [here](#), so even if the book is out-of-reach there is some useful material to look through. Unfortunately my head hits the desk whenever I read the words "structural realism", my bad. Also see this video interview with Nima Arkani-Hamed for a view I can happily agree with <https://www.youtube.com/watch?v=rKvflWg95hs>

## Reference

1. <http://blog.vixra.org/2013/05/16/why-i-still-like-string-theory/>