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BOOK REVIEWS

Not Even Wrong: The Failure of String Theory and the Search for Unity in Physical Law by Peter Woit. Basic Books, New York, 2006. 278 pp. $26.00 (paper), $34.95 (hardcover). ISBN 0-465-09275-6.

The Trouble with Physics: The Rise of String Theory, the Fall of a Science, and What Comes Next by Lee Smolin. Houghton Mifflin, Boston, 2006. 343 pp. $26.00 (hardcover). ISBN 0-618-55105-0.

Throughout human history, we have had, among us, an intellectual elite whose members kindly advise the rest of us as to "what it all means." These advisors have, typically, been the priests of the current religion. And we the people have always been glad to have those priests' potent insight! *Genuinely* glad, because, although we are not so naïve as to expect their advice to be perfect, we are mature enough to know that it is likely the best advice that we are going to get.

So, *how are we doing today*, in this regard? Well, nothing has changed in the sphere of *religious* advice, but there is, of course, a significant *new* element, that of "scientific" insight. Considering the fantastic *practical* successes of science, combined with the essentially *total lack* of *any* practical successes on the side of the priests, it is, perhaps, surprising that most people still *do* stick with those priests (to get what they feel is the real slunny). How can this be?

I think it is because people naturally sense that everything that we scientists are discovering, important as it is, is essentially *superficial*. And, it *is* superficial, in my opinion.

The last truly grand success of physics was in 1925, with the discovery of Quantum Mechanics. There have been many important advances since then, but nothing of the same epochal character.

Until now? Well, this is a book review! I am reviewing two books that take on Superstring theory. If Superstring theory turns out to be correct (if that is even possible), then Superstring theory *is*, just maybe, in the class of quantum mechanics, in terms of its epochal impact.

Both of the books that I am reviewing suggest that that will never happen; that Superstring theory is without a future; that it is in fact a *failed* theory. And both authors are concerned that continued fixation on this failed theory, by professors who won their tenure as its advocates, will retard advances in other directions.

Until very recently, I was a mainstream advocate of superstrings, glibly mouthing the party line: that superstrings produce quantum gravity; that it is the only game in town; and so on. But, I never spent much time teaching it to students. As I explained to the students, "I do like it, but it might not be right. There are other things that *are* right, that are *so* fantastic in their implications that I don't want to waste a great deal of your time on superstrings: I am here of

course referring to Special Relativity, General Relativity, and Quantum Mechanics." I concentrate on teaching *these* three glories, as being things that we *know* are true, and that deeply offend our intuition—which must therefore be suppressed as simply wrong. That is enough to keep me, and the young people, busy! Don't bother me with superstrings and M-theory!

What has changed my mind? An evolution. One important step was hearing Raman Sundrum's wonderful talk at the Albuquerque American Physical Society meeting in 2002, in which he clearly brought out that we have no identified avenue to understand the value of the cosmological constant. His exposition produced a big impact on me, because the calculation of the value is so simple, and produces such a horribly wrong answer. The simple calculation is closely analogous to that which produced the ultraviolet catastrophe, which required the quantum to fix. I decided that something just as fundamental as the quantum was needed here, and . . . forgive me! . . . I ordered my brain to find it.

What am I talking about? Well, we have NO understanding of how our brains work. But we *do* have plenty of examples of peoples' brains actually working, and producing, sometimes, great answers. My favorite example, of both failure and success, is our discovery of vectors.

I ask students, "how *hard* was it, for you, to *learn* vectors?" They reply, in agreement with my own experience, "not totally easy, but no big deal." Well—I then tell them—for our human race to *discover* vectors was very close to *impossible.* Our greatest mathematician, Gauss, tried his hand, and he failed dismally. And, when Hamilton *did* succeed, he did so only via a "lightning bolt," as he and Mrs. Hamilton approached Brougham bridge.

Was Hamilton's discovery of quaternions (essentially, vectors) a gift from God? I think not!

Hamilton had, by working on it, "ordered" his brain to find it, and years of growing synapses in his sleep eventually produced it. That is my petty "theory"! I do not believe that we *can* think anything that is not already wired in our synapses. You have to grow it.

So, *my* brain, such as it is, has been "under orders" for some years now! Any result? Yes, I think so. Perhaps not the brass ring, but, I think, something! In 2006 April I stumbled across an internet paper by Curt Renshaw pointing out that NASA's planned Space Interferometry Mission (SIM) could test the "contraction of length" predicted as part of Special Relativity. I am very interested in physics outreach and student involvement, and I thought that "Was Einstein Right?" would be a great student experiment for SIM. So, I went through the simple mathematics . . . and discovered that the conventional interpretation of length contraction is wrong, and that space is *not* contracted in the direction of motion, but instead is *curled.* A different *topology.*

Well, my paper on the subject is still in the hands of the editors at Physical Review Letters. We shall see!

But there is something else that made me think that Superstring theory might be wrong (before reading the two reviewed books), and that is new experimental

investigations into the reach of Newtonian gravitation. Many theories of extra dimensions suggest that Newtonian gravitation might fail on scales of about a millimeter! Well, it doesn't. It does not fail down to nanometer scales. This we find from dropping neutrons, and watching them bounce under gravity. Brilliant, and conclusive.

But, *the theory can* ***be*** *adjusted,* to *evade* this new result! Well, that is a chief complaint by *both* our authors, Voit and Smolin: that superstring theory is so plastic that it can fit *any* experimental results at all, and hence has neither *any* ability to predict, *nor* the strength of being falsifiable. It is argued that this means that superstring theory is no more a part of science than is Intelligent Design.

You should probably read these two books in the opposite order to what I did. That is, read *Not Even Wrong* first. It is denser, and it will prepare your mind, filling you with all kinds of good ammunition. And, it *accelerates,* becoming somewhat polemical toward the end, and thus firing you up for Lee Smolin's rather more accessible book.

Now, what is all this about? Well, over the decades, physicists have had a rough ride, as they attempted to read the book of nature. Sir Arthur Stanley Eddington in 1927 painted a clear picture of how this "progress" occurs: "Scientific discovery is like the fitting together of the pieces of a giant jig-saw puzzle; a revolution of science does not mean that the pieces already arranged and interlocked have to be dispersed; it means that in fitting on fresh pieces we have had to revise our impression of what the puzzle-picture is going to be like. One day you ask the scientist how he is getting on; he replies, 'Finely. I have very nearly finished this piece of blue sky'. Another day you ask how the sky is progressing and are told, 'I have added a lot more, but it was sea, not sky; there's a boat floating on the top of it'. Perhaps the next time it will have turned out to be a parasol upside down; but our friend is still enthusiastically delighted with the progress he is making."

So how are superstrings coping with the astonishing discovery of a small non-zero positive cosmological constant (by the guys just down the hall from me, with their colleagues)? Why, finely. To stabilize your six hidden dimensions, you must wrap them with branes, and then, to force a *positive* cosmological constant, you again wrap, this time with large numbers of anti-branes, and ... hey presto! Mission accomplished!

There were—how many epicycles in Ptolemy's scheme? And, actually, even *more* in Copernicus's even *more* wretched machine. But, in *Newton's,* arguably *one,* the value of G. And, in superstrings; well, brace yourself, 10^{500}. The particular *one* describing *our* world has not yet been located. *Do not hold your breath!*

Lee Smolin emphasizes the *simplicity* of the *great* results. Special relativity comes from nothing more than changing a sign from + to – in the Pythagorean theorem applied to four dimensions. Smolin points out that he can summarize General Relativity on a single sheet of paper; well, so can I! This is no accident. Eddington: "There are not many things which *can* be said about curvature—not

many of a general character. So that when Einstein felt this urgency to say something about curvature, he almost automatically said the right thing."

And as for quantum mechanics, there is nothing simpler. That is exactly why I think that in the case of quantum mechanics, we do not have an "effective theory," but rather, we have *the real thing.* There is simply no way to make it simpler! I have long been of the opinion that quantum mechanics is not an *option,* that it flows automatically out of the numerical character of observations. And is therefore not in the least bit mysterious.

Quantum mechanics is just the machinery for discussing observations intelligibly. What we are looking for are the symmetries that give rise to the forces (accelerations) that we observe. My suggestion at the moment is that we will find them in the topology of four-space, *not* in added dimensions.

But Ed Witten is there, far ahead of me! Seiberg-Witten invariants! Ed has been highly productive in exploring *this* option, in addition to the superstring path.

It must be difficult for Ed to read the two books I am reviewing (if he has), because really, none of this is his fault. What is he supposed to do, except to try his hardest, which he continues to do? He is smarter than the rest of us, and so, unfortunately, many among us simply look to him for signposts, rather than thinking for ourselves. I am sure that Ed *deplores* this! But, it is definitely not *his* fault!

Woit, in a nuanced fashion, compares Ed with Einstein, pursuing, endlessly, wrong ideas. This is perfectly plausible, given the obtuseness of even a Gauss, as I said! The rest of us do the same in our own smaller spheres.

And where is the answer? Well, maybe, says Smolin, right under your nose! Overlooked! That is something I believe myself, at least as a serious possibility.

Does the next powerful step *have to be* as *simple* as special relativity, general relativity, and quantum mechanics? We simply do not know! The superstring people think *not;* they suspect that truth is a quagmire and that that's all there is to it: a "landscape" of inconceivably vast numbers of chunks of the universe with random physics, and we are in one that looks intelligently designed *because* if it *weren't* we could not be here. End of story!

My *own* hope is that I, or someone else, will find an overlooked symmetry that will result, simply and inevitably, in the standard model with all parameters calculable from first principles. That is the holy grail of physics.

So, *are there* any other things, right under our noses, that we have *not* recognized? I say yes, *big time.* Smolin points to five fundamental problems of physics, but emphasizes that the "greatest mystery of all" is the meaning of quantum mechanics. Then surely most of his book is about this most important problem? Well, no. His treatment of this most important problem is superficial in the extreme. He announces that he is a "realist" and dismisses non-realism (mental universe) on grounds that in the early universe there were no minds! That is, he takes a *conclusion* (that there was an early universe) and deduces his *premise* from that!

The only thing that we actually *know,* is that our minds exist; all else is suspect deduction from what we call "observations." These observations are numbers that occur to us every day and that have patterns in them that we call

a world. But, you can test the *reality* of that world, and it is simply *not there:* e.g., "Measurements Are the Only Reality, Say Quantum Tests." *(Science Magazine,* 1995 December *1,* page 1439.)

Ho-hum, turn the page of *Science,* and go back to simply kicking boulders to refute the pesky mentalists!

Most among us are in denial regarding the obvious. The alternatives are untenable, and counterproductive. I heard Brian Greene talk, fascinating on superstrings, but a look of awe as he indicated his leaning toward "many worlds" quantum mechanics. Why don't I like many worlds? *Not* because the number of worlds makes 10^{500} look like chump change; no, it is because you have introduced your many worlds, with no objective other than to make your electrons *real,* and yet when you are *done* . . . you can't say *one word* about what your now-real electrons *are.* It is simply nonsense!

I highly recommend both of these books; they deserve a wide audience.

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Serious Adverse Events: An Uncensored History of AIDS by Celia Farber. Melville House, Hoboken, NJ, 2006. 340 pp. $16.95 (paper). ISBN 1-933-63301-8.

This book is drawn largely from the author's coverage of AIDS over two decades, with important additional material. Farber says she is not equipped to know whether HIV causes AIDS, but much of what she writes speaks against the orthodox view.

Chapter 1 is already worth the price of the book, about Peter Duesberg, his work on cancer, his steady argument that HIV is not the cause of AIDS, and how that view has caused him to be treated in a truly despicable manner by professional peers and by local colleagues. Those unfamiliar with academe may not wish to believe the pettiness, jealousy, and mob mentality that Farber describes, yet it rings perfectly true; it is perhaps summed up by the anonymous interviewee who blames Duesberg for his own troubles because he would not just go along to get along (pp. 54–56). Farber ventures the correct diagnosis: scientists need funding, universities crave money and prestige, the system has become bureaucratic, and mediocrities rule (Bauer, 2004). So—I add—came grade inflation, the demise of intellectual standards, and bullying by the thought police. The president of my own university asked a renowned teacher, who had been absurdly accused of sexual harassment for a feeble joke made in class in