

THE BACKGROUND PROBLEM

The problem seems to me how one can formulate statements about a discontinuum without calling upon a continuum (space-time) as an aid; the latter should be banned from the theory.

Albert Einstein (1917)

I believe that the essential discovery about nature encoded into general relativity is ... that position with respect to a “background” spacetime is a meaningless concept.

Carlo Rovelli (1997)

Lee Smolin has argued that ANY sort of background structure is a bad thing in a fundamental theory of physics. Of course, taken to its ultimate limit, this philosophy can lead to problems.

John Baez (2000)

It should also be said that for physicists relationalism is a strategy. As we shall see, theories may be partly relational, i.e., they can have varying amounts of background structure.

Lee Smolin (2008)

Let's get the language clear, I'm thinking as I walk. Well, fairly clear. The deeper that one digs the more it seems this background business is a murky problem.

A theory that assumes even a tiny bit of background is not Relational. A Relational theory is one that has events that have no background, only a relation. As in, for example, *A* links to *B*. It can go on to say, *B* links to *C*. ‘Link’ being a relation. There must be nothing that can say where *A* or *B* or *C* are to be found. If there is a way to say where, there is background.

For a long time having background doesn't seem to be a problem. Physics is built on the rock of background. But Einstein starts to think that this could be a problem. But what *I* think is, it is a problem if you're after the Beginning.

“So it is my problem,” he says to me as I close the office door.

So it isn't what I write that gets to him, it's what I think. I sit and boot and write it anyway.

I think if a theory has any background—even the least little bit—it cannot be a theory of the Beginning. It seems simple: Any background is by definition something that's not in the theory. If there's anything outside the theory, it's not a theory about the universe because nothing is outside the universe. The universe is all there is; that's what it means. I hope he gets it. This, for him, is literally all or

nothing. Yet I find it troubling: A universe that has no place to *be*? It's like picturing a painting with no canvas, only tougher.

So the Background Problem is it is impossible to build a theory of the whole universe *within* a background, but it seems impossible to build a theory of the whole universe *without* one. Where does one begin?

“The rabbit asks the King of Hearts, remember?”

I don't. So how does he? I google: rabbit asks king hearts where begin. And there it is: Begin at the beginning, says the King, says Wikiquote.

It's been a while since I went through this for her Frank. Lots more reading tells me that both GR and QM depend upon a background. I find Smolin is on record saying GR's background-*independent*; and as saying that GR is not. He explains that it's a bit of both. It has much less background than QM. But it isn't totally Relational, not in the sense that he himself defines.

Smolin favors a Relational strategy. This is what he calls it. He would have physicists cut down the background of existing theories piece by piece. As he puts it, they should ‘seek to make progress by identifying the background structure in our theories and removing it, replacing it with relations which evolve subject to dynamical law.’ I'm not sure it is a strategy but at least it is a plan. It's a plan that seems a bit like trying to work all the way back to Time Zero with the LHC. It's a plan that's based on being partly pregnant. It's not a plan to meet the mandate of the King of Hearts. As my two-fingered typing idly types these last few words I get a strange sensation—not quite a spinal chill nor hackles rising—with the recognition this is what the voice just said. It was meant to be a contribution.

Absence of background is not just important for my Frank; it is strategic. It's related to the aether problem since the aether seems to be a background—a canvas on which physics paints all through the easy days when no one sees it as a snare and a delusion. Which phrase is from our physics-finished friend Lord Kelvin, more or less. In 1902 he shares his view of flying machines he says will not fly. At least, he says, they will not carry people. He may be excused—it will be 10 years before Beach opines that ‘the coach builders will soon be called upon to make closed bodies for aeroplanes the same as they do for automobiles’—but once again he has it wrong.

Frank and Lewis Carroll, his King and his rabbit—my bet says between the four of them they get it.