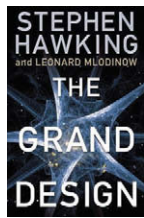


There is no theory of everything

Stephen Hawking has given up on an ultimate theory. Perhaps it's a little soon, says **Craig Callender**

The Grand Design by Stephen Hawking and Leonard Mlodinow, Bantam, \$28/£18.99



THREE decades ago, Stephen Hawking famously declared that a “theory of everything” was on the horizon, with a 50 per cent chance of its completion by 2000. Now it is 2010, and Hawking has given up. But it is not his fault, he says: there may not be a final theory to discover after all. No matter; he can explain the riddles of existence without it.

The Grand Design, written with Leonard Mlodinow, is Hawking’s first popular science book for adults in almost a decade. It duly covers the growth of modern physics (quantum mechanics, general relativity, modern cosmology) sprinkled with the wild speculation about multiple universes that seems mandatory in popular works these days. Short but engaging and packed with colourful illustrations, the book is a natural choice for someone wanting a quick introduction to mind-bending theoretical physics.

Early on, the authors claim that they will be answering the ultimate riddles of existence – and that their answer won’t be “42”. Their starting point for this bold claim is superstring theory.

In the early 1990s, string theory was struggling with a multiplicity of distinct theories. Instead of a single theory of everything, there seemed to be five. Beginning in 1994, though, physicists noticed

that, at low energies, some of these theories were “dual” to others – that is, a mathematical transformation makes one theory look like another, suggesting that they may just be two descriptions of the same thing. Then a bigger surprise came: one string theory was shown to be dual to 11-dimensional supergravity, a theory describing not only strings but membranes, too. Many physicists believe that this supergravity theory is one piece of a hypothetical ultimate theory, dubbed M-theory, of which all the different string theories offer us mere glimpses.

This multiplicity of distinct theories prompts the authors to declare that the only way to understand reality is to employ a philosophy called “model-dependent realism”. Having declared that “philosophy is dead”, the authors unwittingly

develop a theory familiar to philosophers since the 1980s, namely “perspectivalism”. This radical theory holds that there doesn’t exist, even in principle, a single comprehensive theory of the universe. Instead, science offers many incomplete windows onto a common reality, one no more “true” than another. In the authors’ hands this position bleeds into an alarming anti-realism: not only does science fail to provide a single description of reality, they say, there is no theory-independent reality at all. If either stance is correct, one shouldn’t expect to find a final unifying theory like M-theory – only a bunch of separate and sometimes overlapping windows.

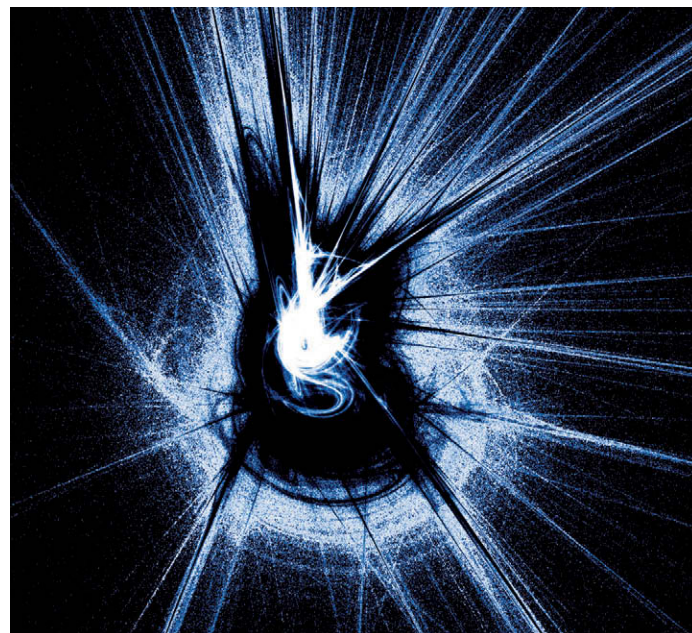
“Not only is there no single description of reality, there is also no theory-independent reality”

So I was surprised when the authors began to advocate M-theory. But it turns out they were unconventionally referring to the patchwork of string theories as “M-theory” too, in addition to the hypothetical ultimate theory about which they remain agnostic.

M-theory in either sense is far from complete. But that doesn’t stop the authors from asserting that it explains the mysteries of existence: why there is something rather than nothing, why this set of laws and not another, and why we exist at all. According to Hawking, enough is known about M-theory to see that God is not needed to answer these questions. Instead, string theory points to the existence of a multiverse, and this multiverse coupled with anthropic reasoning will suffice. Personally, I am doubtful.

Take life. We are lucky to be alive. Imagine all the ways physics might have precluded life: gravity could have been stronger, electrons could have been as big as basketballs and so on. Does this intuitive “luck” warrant the postulation of God? No. Does it warrant the postulation of an infinity of universes? The authors and many others think so. In the absence of theory, though, this is nothing more than a hunch doomed – until we start watching universes come into being – to remain untested. The lesson isn’t that we face a dilemma between God and the multiverse, but that we shouldn’t go off the rails at the first sign of coincidences. ■

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Is M-theory a single theory of the universe or a collection of theories?

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