



SCIENCE

# Stephen Hawking and the Mother of theories

The Universe in a Nutshell  
By Stephen Hawking  
Bantam, 216 pages, \$53

REVIEWED BY MICHAEL R. LeGAULT

Time is neither infinite or constant; it merely appears to be so. Space may have as many as 11 dimensions, with most curled up very small, leaving the three dimensions we perceive. You, your toast and rose bushes are nothing more than the sum of sundry vibrations on different loops of tiny strings. The universe does not have just one history, but multiple histories, including one in which Canada wins all the Olympic gold medals: This and most others are merely less likely to occur.

Such are the conceptual conundrums on display in Stephen Hawking's curiosity shop, known otherwise as modern cosmology and theoretical physics. The sign hanging over the entrance says "Concentration, imagination and some calculations required." But wait, haven't we been here before?

Indeed we have. Once, in 1988, when a fascinating collection of facts, cryptic speculation and theoretical shenanigans were brought together in an exhibit titled *A Brief History of Time*. Line-ups, we recall, stretched out the door and around the corner. The show, as charted by The London Sunday Times and other publications,

achieved mythical, record-setting status. For perhaps the first time in the history of popular culture, people were overheard on trains and in offices discussing the Doppler effect and scientific determinism.

Subsequent offerings from the curator of this cosmological arcana, who today is the most widely recognized scientist since Einstein, revealed that he has never really been able to let go of this life-changing debut.

In *Black Holes and Baby Universes* (1992), Hawking muses that he should have done a better job in his first book of explaining concepts such as imaginary time and quantum mechanical theory of black holes; then, in a number of essays, he buckles down to the job of renovation. In the warmer, fuzzier *Illustrated Brief History of Time* (1996), the appended pictures are intended to provide us "an alternative route" to the original book's text, which the author has apparently come to view as a bane on the reader.

A concern for clarity is admirable. It may be the penchant of genius to revisit, refine and never yield to imperfection. The reader confronting Hawking's colourful new glossy work must mundanely wonder, however, if the book actually contains anything new, either in content or perspective, or if it is another reworking of the same themes taken up in *Brief History*.

Indeed, for many it will not matter. The universe is an intriguing subject and, especially in the last 20 years, coming to terms with the theories proposed to explain how it works has proved an increasing conceptual challenge to a brain that evolved to survive on the plains of Africa 200,000 years ago. There is something to be said for learning the basics of relativity and quantum theory (again) at the knee of the man who occupies the Lucasian Chair of Mathematics at Cambridge once held by Sir Isaac Newton.

With *The Universe in a Nutshell* (the title is an allusion to both a quote from *Hamlet* and a proposed model of the universe that is unbounded but finite or closed), Hawking has settled on the pictorial approach to help illuminate these ideas. The pictures, for the most part, are computer-generated and, as with the *Illustrated Brief History of Time*, provide a substitute story line for the text, rather than graphical insight. Captions are often cribbed directly from the text beside or below the illustrations.

Being glossy, the book is intended to be browsed, and Hawking has made efforts to accommodate by arranging the chapters in a non-linear way. This "reader friendliness," he makes

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sure we know, is one thing that distinguishes the book from *A Brief History*.

But there is also nominal new content, most notably in the latter pages, when Hawking considers the possibility of utopia and new developments in the quest for a Theory of Everything (TOE).

Hawking is the world's foremost authority on black holes, those cosmically sinister objects possessing such massive amounts of gravity that not even light can escape their clutches. More generically, Hawking's interest in reconciling quantum theory (small scale) with Einstein's theory of general relativity (large scale), puts him in close theoretical proximity to TOE work and its main bugaboo — finding a way to connect gravity with the smaller-scale nuclear and atomic forces.

M-theory (for mother-of-all theories) is currently considered the best candidate for a TOE. M-theory, which says space is composed of 10 or 11 dimensions, is a unification of various string theories,

which are in turn embody different elements of quantum theory and general relativity. While mathematically consistent, the theory may never be testable. Lack of experimental confirmation has put theoretical physicists in a quandary. In order to assuage this doubt, Hawking and others have begun to invoke the term "positivism." It is vaguely explained, but Hawking seems to mean by it that mathematical consistency in itself can be viewed as evidence for a certain type of underlying reality.

Whether or not positivism becomes a staple in the glossary of physics textbooks remains to be seen. Many physicists, Hawking notes, are hoping the state-of-the-art particle accelerator being built in Geneva will reveal at least some vestige of the reality predicted by M-theory. Until then, perhaps we can find some solace in the fact that the basic principles of physics are confirmed every time we take a flight or turn on our computers.

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