What Place for a Creator?
By Marcia Bartusiak
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What Place for a Creator?

A BRIEF HISTORY OF TIME
From the Big Bang to Black Holes.
By Stephen W. Hawking.
Illustrated by Ron Miller.
198 pp. New York: Bantam Books. $18.95.

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THE history of physics in the 20th century is a tale of two revolutions — general relativity and quantum mechanics. Both upheavals forced physicists to adopt new ways of thinking at each end of the distance scale. At the level of atoms and nuclear particles, quantum mechanics replaced surety with uncertainty. Researchers learned that events within that minuscule realm do not flow smoothly and gradually; rather, they change abruptly and discontinuously. Nature became a game of probability. At the same time, over the vast distances between stars and galaxies, Einstein's theory of general relativity instructed us that gravity, the weakest of nature's forces, is best described as a geometric effect, a curvature or warp in space-time. In this view, the earth remains in orbit simply because it is caught in the indentation our massive sun makes in space.

The next triumph in physics will arrive when these two seemingly diverse provinces are connected. Stephen W. Hawking, who occupies the Lucasian chair of mathematics at Cambridge University in England (as Sir Isaac Newton did), has been attempting to accomplish just that. Early in his legendary career, Mr. Hawking realized that a full understanding of the universe's birth, as well as a determination of its end, will not be attained until the macrocosm is joined with the microcosm in one unifying theory.

As the title implies, "A Brief History of Time" is a succinct review of this challenging task, providing the reader with a jaunty overview of key cosmological ideas, past and present — including multidimensional space, the inflationary universe and the cosmic fates that may befall us. Special attention is paid to how nature's forces — gravity, electromagnetism and the strong and weak nuclear forces — are related to one another. Time takes center stage because it is a concept that has no meaning before our celestial genesis. Both space and time emerged at the instant of creation.

In an era of deficits and bottom lines, it is reassuring to hear Mr. Hawking defend this esoteric field for its own sake. As a nation now waffling in its commitment to basic science, will we heed the advice? "The discovery of a complete unified theory . . . may not aid the survival of our species," Mr. Hawking says. "It may not even affect our life-style. But ever since the dawn of civilization, people have not been content to see events as unconnected and inexplicable. . . . Humanity's deepest desire for knowledge is justification enough for our continuing quest. And our goal is nothing less than a complete description of the universe we live in."

Mr. Hawking himself has pursued this elusive prize in the face of overwhelming obstacles. In 1963, while still a college student, he was diagnosed as having amyotrophic lateral sclerosis, commonly known as Lou Gehrig's disease, and was given two years to live. Long confined to a wheelchair, his labored speech impossible to understand without an interpreter, he has defied the odds a dozen times over. He married and has been working on the most captivating problems in astrophysics — from cosmic birth to stellar death — for more than two decades.

THE American physicist John A. Wheeler once said that "physicists, like patients in a physician's office, only really believe they know what their problem is when it has been given a name." In 1968, Mr. Wheeler gave the black hole its name, initiating a public fascination that has scarcely abated. This bizarre celestial creature was the dark, gravitational abyss from which no light or matter could escape for all eternity, the result of a massive star collapsing to oblivion in its old age. And at the black hole's center resided a point of infinite density, called a singularity, where the known laws of physics completely broke down.

However, prompted by a discussion with two Soviet theorists, Mr. Hawking startled the astronomical community nearly 20 years ago when he announced that black holes "ain't so black." "One evening in November [1970], shortly after the birth of my daughter, Lucy," he recalls, "I started to think about black holes as I was getting into bed. My disability makes this rather a slow process, so I had plenty of time."

While largely written in the style of a scholarly lecture, "A Brief History of Time" lights up at such moments, when Mr. Hawking allows us a peek at his impish humor, inner motivations, theoretical goofs and scientific prejudices. Science buffs yearn for such personal admissions from scientist-authors working at the frontier. Only then can the scientific process, so often viewed as dry and pedantic, be rightfully perceived as a natural function of the human endeavor. Although this book was clearly not intended to be an autobiography, it is still disappointing that Mr. Hawking keeps such revelations to a minimum.

In applying the laws of quantum mechanics to the strange, warped space surrounding black holes, Mr. Hawking discovered that they are probably evaporating by slowly emitting radiation. These collapsed stars, then, are not so immortal. Given enough time, about a trillion trillion trillion trillion trillion trillion years, stel-

Marcia Bartusiak's most recent book is "Thursday's Universe."

lar black holes, along with their singularities, would actually disappear.

By the 1980's, Mr. Hawking extended his studies to the greatest singularity of them all — the primordial seed that evidence suggests wildly expanded some 15 billion years ago to produce the universe as we know it. Considering how quantum mechanics dramatically altered the physics of the black hole, Mr. Hawking tells us how present conceptions of the big bang might be equally affected.

In his preliminary figurings, Mr. Hawking surmises that the embryonic universe did not emerge from a singularity. Instead, he imagines a union of space and time that was finite yet boundless in the beginning, much the way the surface of a globe has no edges. Now expanding, this four-dimensional bubble is fated to contract innumerable eons from now. Current astronomical observations do not support Mr. Hawking's vision, as yet; not enough matter, either luminous or dark, has been found to close the universe back up. Indeed, the author admits that his idea is merely a theoretical proposal at this point, even an esthetic wish. "But if the universe is really completely self-contained, having no boundary or edge," he muses, "it would have neither beginning nor end: it would simply be. What place, then, for a creator?"

SOME may feel uncomfortable at Mr. Hawking's mention of a creator, a theme that resonates throughout the book. The job of science, after all, is to explain the world around us without invoking divine interventions. Philosophically, though, his question is a valid one. If science should truly develop a "theory of everything," does the need for a Supreme Being vanish?

To help solve this conundrum, Mr. Hawking longs for the return of the philosopher-scientist, perhaps someone like Immanuel Kant, who in the 18th century hypothesized the existence of "island universes" beyond the Milky Way galaxy. Yet with astronomical discoveries and grand unifying theories increasing at an exponential rate and the mathematical language of physics becoming more and more arcane, nonspecialists are severely hampered in forging a synthesis. What is learned today changes tomorrow. "However, if we do discover a complete theory," Mr. Hawking writes, "it should in time be understandable in broad principle by everyone, not just a few scientists. Then we shall all, philosophers, scientists, and just ordinary people, be able to take part in the discussion of the question of why it is that we and the universe exist. If we find the answer to that, it would be the ultimate triumph of human reason — for then we would know the mind of God."

Through his cerebral journeys, Mr. Hawking is bravely taking some of the first, though tentative, steps toward quantizing the early universe, and he offers us a provocative glimpse of the work in progress. □