

ORIGINS: The Lives and Worlds of Modern Cosmologists. By Alan Lightman and Roberta Brawer. Harvard. 563 pp. \$29.95

"Search for the origins of the universe and contemplate its demise." That would make a droll job description, but it is exactly what cosmologists do. Their field is the Big Picture: Cosmologists work in time frames of billions of years, in distances measured in light years, and in media that consist of subatomic particles and microwaves from outer space. They get into heated debates over what happened in the universe during its first 10^{-43} second, which they even have a name for—the Planck Era. Another age might have called their work an act of faith: Cosmologists elaborate theories based on particles whose existence has yet to be proved. "Cosmology is about as different as it can be from our laboratory sciences," writes cosmologist Margaret Geller. "You have to have a sense of humor about it because the likelihood of ever being right is so low."

In *Origins*, physicists Lightman and Brawer interview prominent cosmologists about their sense of humor as well as their professional accomplishments and their theories. Their goal is to understand a profession that obtained its scientific legitimacy scarcely a generation ago. In 1965 Robert Dicke predicted the existence of, and then found, background radiation coming from every direction in space. The big bang theory—which holds that the universe was born around 10 billion years ago, when all matter was compressed to extreme density and extreme temperature, then exploded, expanded, and cooled—offered an explanation for this radiation. This, along with the fact that the big bang theory accounted for the known hydrogen/helium composition of the universe, Lightman and

Brawer write, "convinced many scientists for the first time that cosmology had some contact with reality, that cosmology was a legitimate science."

It is hard for a mere mortal to hear about the big bang theory without immediately wondering: Yes, but what was going on in the second right before the big bang? The cosmologists whom Lightman and Brawer interviewed express more technical reservations. Alan Guth of MIT discusses the "horizon problem." According to the big bang theory, the universe should be more random than it is: Recent discoveries reveal all galaxies to be neatly organized in patterns that resemble bubbles. Then there is the "flatness problem"—the universe's mass seems to be just the amount needed to balance it between endless collapse and endless expansion—a freaky coincidence for which big bang theory offers no explanation.

Given such quandaries, Lightman and Brawer attempt to find where inspiration and personal preference influence theories that are as yet unprovable. (One interesting speculation is how the two posters of Marilyn Monroe on Stephen Hawking's wall have shaped his work.) Dicke, for example, whose discovery seemed to substantiate big bang theory, actually prefers a competing theory—that of an "oscillating universe" without beginning—and his reasons seem quite personal: "I wasn't impressed with the thought that you could suddenly make all that matter that we see around us in 10^{20} seconds A universe that is suddenly switched on I find highly disagreeable." Or as Guth says,

"If you can't explain the beginning [of the universe], it's not *nice* to have a beginning."

Lightman and Brawer have provided us with an intellectual portrait of 27 *nice* human beings, explaining a science and indeed a universe no human being will ever see, hear, or touch.

