

An article a day of enduring significance, in condensed permanent booklet form

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Condensed from
NEW YORK TIMES
MAGAZINE

ROBERT JASTROW

*Einstein, left, and astronomer Edwin Hubble at the
100-inch Mount Wilson telescope in 1930*

Have Astronomers Found God?

WHEN AN ASTRONOMER writes about God, his colleagues may assume he is either over the hill or going bonkers. In my case it should be understood from the start that I am an agnostic in religious matters. However, I am fascinated by strange developments

going on in astronomy—partly because of their religious implications and partly because of the peculiar reactions of some of my colleagues.

The essence of these developments is that the universe had a sharply defined beginning—that it began at a certain moment in

time. Was the creative agent one of the forces of physics, or was it, as the Old Testament Apocrypha says, "thy almighty hand, which created the world out of formless matter"?

The crux of the new story of Genesis, better known as the "big-bang" theory, is that we live in an expanding universe, in which all the galaxies around us are moving away from us and one another at enormous speeds. It is as if we are witnessing the aftermath of a gigantic explosion. If we trace the motions of the outward-moving galaxies backward in time, we find that they all come together roughly 20 billion years ago.

At that time, all the matter in the universe was packed into a dense mass, at temperatures of many trillions of degrees. The dazzling brilliance of the radiation in this dense, hot universe suggests the explosion of a cosmic hydrogen bomb. The instant in which the cosmic bomb exploded marked the birth of the universe.

The essential elements in the astronomical and Biblical accounts of Genesis are the same: The chain of events leading to man commenced suddenly and sharply at a definite moment in time, in a flash of light and energy.

Some scientists are unhappy with the idea that the world began in this

way. Until recently, many preferred the steady-state theory, which holds that the universe had no beginning, and is eternal. But astronomical evidence makes it almost certain that the big bang really did occur.

The scientific story that leads to the big-bang theory began in 1912 at the Lowell Observatory in Flagstaff, Ariz. There, American astronomer Vesto Melvin Slipher discovered that about a dozen galaxies are moving away from the earth at speeds up to a million miles an hour. Slipher reported his extraordinary finding at a meeting of the American Astronomical Society in Evanston, Ill., in 1914. He presented his paper with great modesty, but his slides clearly revealed the telltale red shift (a change in the color of the light) that indicated an enormously rapid motion of these galaxies. "Then something happened which I have never seen before or since at a scientific meeting," recalled astronomer John Miller, who was in the audience. "Everyone stood up and cheered."

Although Slipher's colleagues did not know exactly what his discovery meant, they felt that it was of great importance. Also in the audience was Edwin Hubble, who later picked up Slipher's clues and built them into a new picture of the universe.

Mounting Evidence. In Germany, two years after Slipher reported his discovery, Albert Einstein published his equations of general relativity. Almost immediately, Dutch astronomer Willem de Sitter found a solution to them that predicted an

ROBERT JASTROW, director of NASA's Goddard Institute for Space Studies and professor of astronomy and geology at Columbia University, is the author of *Red Giants and White Dwarfs, Until the Sun Dies* and *God and the Astronomers*.

expanding universe in which the galaxies of the heavens moved rapidly away from one another.

Einstein had failed to notice that his theory predicted an expanding universe, and later he missed still another expanding-universe solution to his own equations. This time, Russian mathematician Alexander Friedmann found that Einstein had made a schoolboy's error in algebra, which caused him to overlook the additional solutions. In effect, Einstein had divided by zero at one point in his calculations—a "no-no" in mathematics. As soon as Friedmann corrected the error, the missing solution popped out. Einstein was irked by Friedmann's discovery of his mistake. In a rare display of churlishness, he first ignored Friedmann's letter describing the new solution and subsequently debunked it in print. But, by 1923, he had acknowledged his double error.

De Sitter's theoretical prediction of an expanding universe made a great impression on astronomers immediately after World War I. For the first time, they saw the larger significance in Slipher's discovery of the outward-moving galaxies. Nevertheless, signs of irritation began to reappear among the scientists. Einstein was disturbed by the idea of a universe that blows up, because it implied that the world had a beginning. In a letter to de Sitter, Einstein wrote, "This circumstance [of an expanding universe] irritates me."

This is curiously emotional language for a discussion of some math-

ematical formulas. I suppose that the idea of a beginning in time annoyed Einstein because of its theological implications. He had well-defined feelings about God, but not as the Creator. For Einstein, the existence of God was proved by the laws of nature; that is, the fact that there was order in the universe, and that man could discover it.

In the early 1920s, Edwin Hubble and Milton Humason began to follow up on Slipher's work—using the 60-inch telescope on California's Mount Wilson. Then they attacked the problem with the 100-inch telescope, the world's largest at that time. Hubble and Humason measured the speeds and distances of many galaxies too faint to be seen by Slipher with his smaller instrument, and confirmed Slipher's discovery; all the galaxies were moving away from us at high speeds. Some were retreating at the extraordinary speed of 100 million miles an hour.

In 1929, Hubble came upon the relationship now known as Hubble's law: *The farther away a galaxy is, the faster it moves.* The same law was predicted by Einstein's theory of relativity. The agreement made a tremendous impression on astronomers.

But Einstein resisted the new developments until 1930, when he visited Hubble at the Mount Wilson Observatory in Pasadena. He studied Hubble's plates, looked through his telescope, and announced himself convinced. Now that evidence pointed to the fact that the universe had a

beginning, a few scientists dared to ask, "What came before the beginning?" Some, even bolder, asked, "Who was the Prime Mover?" The British theorist Edward Milne wrote a mathematical treatise on kinematic relativity, which concluded by saying, in the context of expansion, "The first cause of the universe is left for the reader to insert. But our picture is incomplete without Him."

Nevertheless, the views of most physicists and astronomers were closer to that of the theologian who, when asked what God was doing before He created the materials of heaven and earth, replied, "He was creating hell for people who asked questions like that." In fact, some prominent scientists began to feel the same irritation over the expanding universe that Einstein had expressed earlier.

The Clincher. Then, in 1965, Arno Penzias and Robert Wilson of the Bell Laboratories discovered that the earth is bathed in a faint glow of radiation coming from every direction in the heavens. The measurements showed that the earth itself could not be the origin of this radiation, nor could any other particular object in the sky. The entire universe seemed to be the source.

The two physicists, puzzled by their discovery, did not realize that they had stumbled upon the answer to one of the cosmic mysteries. Scientists who believed in the big-bang theory had long asserted that the universe must have resembled a white-hot fireball in the first mo-

ments after the big bang occurred. Gradually, as the universe expanded and cooled, the fireball would have become less brilliant, but its radiation would never have disappeared entirely. It was the diffuse glow of this ancient radiation, dating back to the birth of the universe, that Penzias and Wilson apparently discovered.

The clincher, which has convinced almost the last doubting Thomas of the big-bang theory, is that the radiation discovered by Penzias and Wilson has exactly the pattern of wavelengths expected for the light and heat produced in a great explosion.

Reception Committee. Theologians generally are delighted with the proof that the universe had a beginning, but astronomers are curiously upset. Their reactions provide an interesting demonstration of the response of the scientific mind—supposedly a very objective mind—when evidence uncovered by science itself leads to a conflict with the articles of faith in our profession. A few years ago in a British Broadcasting Corporation film on cosmology, astronomer Philip Morrison of M.I.T. said, "I would like to reject the big-bang theory, but I have to face the facts."

This reaction and similar responses by other astronomers have an odd ring of feeling and emotion. They come from the heart, whereas you would expect such judgments to come from the brain. Why?

I think part of the answer is that scientists cannot bear the thought of a natural phenomenon that cannot

be explained. There is a kind of religion in science; it is the religion of a person who believes that every event in the universe can be explained in a rational way as the product of some previous event. This faith is violated by the discovery that the world had a beginning under conditions in which the known laws of physics are not valid, and as a product of forces we cannot discover. When that happens, the scientist has lost control. He reacts by ignoring the implications, or by trivializing and calling it the big bang, as if the universe were a firecracker.

Consider the immensity of the problem. Science has proved that the universe exploded into being at a certain moment. It asks, What cause produced this effect? Who or what put the matter and energy into the universe? Was the universe created out of nothing, or was it gathered together out of pre-existing materials? And science cannot answer these questions, because, according to the astronomers, in the first moments of its existence the universe was compressed to an extraordinary degree, and consumed by the heat of a fire beyond human imagination. The shock of that instant must have destroyed every particle of evidence that could have yielded a clue to the

cause of the great explosion. The scientist's pursuit of the past ends in the moment of Creation.

This development was unexpected by all but the theologians. They have always accepted the word of the Bible: *In the beginning God created the heaven and the earth.* But we scientists did not expect to find evidence for an abrupt beginning because we have had, until recently, such extraordinary success in tracing the chain of cause and effect backward in time. We have been able to connect the appearance of man on this planet to the crossing of the threshold of life, the manufacture of the chemical ingredients of life within stars that have long since expired, the formation of those stars out of the primal mists, and the expansion and cooling of the parent cloud of gases out of the cosmic fireball.

Now we would like to pursue that inquiry further back in time, but the barrier seems insurmountable. For the scientist who has lived by his faith in the power of reason, the story ends like a bad dream. He has scaled the mountains of ignorance; he is about to conquer the highest peak; as he pulls himself over the final rock, he is greeted by a band of theologians who have been sitting there for centuries.

Cabin Fever

AFTER FOUR ADULTS, a child and two dogs had spent ten days traveling through three states and sleeping in a small trailer, the child, our two-year-old daughter, proudly told everyone, "We've been cramping out!"

—Contributed by Mrs. Bob Killebrew

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The exit was blocked
by a swelling river, and
the spelunkers were already
drenched in frigid
mountain water

TRAPPED IN A FLOODING CAVE

By ALLEN RANKIN

IT WON'T BE LONG NOW," Barry Beck said. "We'll be out of here in 20 minutes." A geology professor and veteran caver at 34, Beck had led members of the Outdoor Club of Georgia Southwestern College on an expedition to Anderson Springs Cave in the Appalachians of north Georgia. It had been fun. But by now, 4:30 on a chilly Saturday afternoon in March 1979, the nine club members who had stuck the trip out to the end were tired and cold, especially five who were on their first spelunking expedition. They



magnetic radiation. In the past, studies by utility companies, the military and environmentalists have been ignored or attacked because their results were labeled biased.

3. On the basis of research findings, we must urge the government to establish *legal* safe standards for exposure to and emission of electric radiation.

4. We must encourage putting high-voltage lines underground, however costly the process may be. Thus shielded, their electromagnetic smog will pose less of a hazard. Tax incentives could be offered to companies that bury their cables.

5. We must limit electric smog through state and local action. For example, often television and radio transmitters sit atop tall buildings in city centers, and federal Environ-

mental Protection Agency measurements show that they heavily irradiate people in nearby tall buildings and on the streets below. When EPA tests declared Portland, Ore., one of the electrically "smoggiest" cities in America in 1976, citizens blocked construction of a new television transmitter. Oregon's legislature is considering a law to make electromagnetic polluting a crime.

STEPS such as these will help to reduce hazards posed by electric smog. Just as cave dwellers discovered and only later learned to live safely with fire, we must learn to handle radiant electricity with greater care.

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Caught in Passing

ONE SECRETARY to another: "The efficiency expert has had his eye on me lately. I don't know whether to get busy or act interested."

—Lichty, Field Newspaper Syndicate

MAN IN CARPOOL: "I'm so grouchy when I wake up in the morning, even the news cheers me."

—*Weight Watchers Magazine*

ON A BUS: "You are looking at a man whose disposable income has been entirely disposed of."

—William D. Tammeus in *Kansas City Star*

BUSINESSMAN'S CRY: "I leave my problems at work—I have another set at home."

—Vagabond Creations

MAN DESCRIBING NEW HOUSE in suburbs: "Everything is built in except the price—that's jacked up."

—Contributed by Colleen B. Pifer

CONGRESSMAN to colleague: "I'm a little right of where center was last week."

—Franklin P. Jones in *Quote Magazine*

How Things Really Work

"Never try to be nice to a man with a tattoo on his face," was all that one note said. Another envelope in the same day's mail contained no less than 150 laws, maxims, injunctions and explanations. Such is the range of material (thousands of pieces of it) that has come to Paul Dickson since the publication in 1978 of his book of universal verities, *The Official Rules*.^{*} This summer, Dickson's second book of concise discoveries about the world and how it *really* works will be published. Here's a selection intended to edify—and, of course, entertain.

^{*}See "Any Fool Can Make a Rule," *The Reader's Digest*, March '79.

Condensed from
"THE OFFICIAL EXPLANATIONS"

PAUL DICKSON

Fuchs's Warning. If you actually look like your passport photo, you aren't well enough to travel.

—Sir Vivian Fuchs

Epperson's Law. When a man says it's a silly, childish game, it's probably something his wife can beat him at.

—Don Epperson, quoted by Bill Gold in *Washington Post*

Miller's Corollary. Objects are lost because people look where they are not instead of where they are.

—Henry L. Miller

Fields's Revelation. If you see a man holding a clipboard and looking official, the chances are good that he is supposed to be doing something menial.

—Wayne C. Fields, Jr.

Bismarck's Law. The less people know about how sausages and laws are made, the better they'll sleep at night.

—Otto von Bismarck

Business Maxims. Signs, real and imagined, which belong on the walls of the nation's offices: 1) Never Try to Teach a Pig to Sing; It Wastes

Your Time and It Annoys the Pig. 2) Sometimes the Crowd Is Right. 3) Auditors Are the People Who Go in After the War Is Lost and Bayonet the Wounded. 4) To Err Is Human—To Forgive Is Not Company Policy.

—1, 2. *MBA Magazine*; 3. Paul Rubin; 4. E. H. Bulen

Chesterton's Discovery. The only way of catching a train is to miss the train before.

—G. K. Chesterton

Ertz's Observation on Immortality. Millions long for immortality who do not know what to do with themselves on a rainy Sunday afternoon.

—Susan Ertz

Benchley's Travel Distinction. In America there are two classes of travel: first class and with children.

—Robert Benchley

Herman's Rule. If it works right the first time, you've obviously done something wrong.

—Pat (Mrs. Herman) Jett

The Johns Hopkins Miraculous Secret for the Early Recovery of Patients. Inflation.

—Unknown nurse

Jones's Rule of the Road. The easiest way to refold a road map is differently.

—Franklin P. Jones

Litt's Paradox of Deadlines. The reason for the rush is the delay and, conversely, the reason for the delay is the rush.

—Lawrence Litt

Maugham's Advice. Death is a very dull, dreary affair, and my advice to

you is to have nothing whatsoever to do with it.

—Somerset Maugham

Marxist Law of the Distribution of Wealth. Shortages will be divided equally among the peasants.

—John W. Gustafson

Old Boy's Law. You don't learn anything the second time you're kicked by a mule.

—Anonymous

Olmstead's Law. After all is said and done, a hell of a lot more is said than done.

—Clark Olmstead

Parsons's Rule. At whatever stage you apologize to your spouse, the reply is constant: "It's too late now."

—Denys Parsons

Quigley's Law. If you take off your right-hand glove in very cold weather, the key will be in your left-hand pocket.

—Martin Quigley

Rose's First Law of Investments. Never invest your money in anything that eats or needs repainting.

—Billy Rose

Sieger's Law. You will have the same amount of money left at the end of the month, no matter how many raises, bonuses or windfalls occur during the month.

Woehlke's Law. Nothing is done until nothing is done.

—Richard A. Woehlke

Thomas's Rules of the Game. 1) No matter how well you do something,

THE READER'S DIGEST

someone won't like it. 2) No matter how trivial the assignment, it is always possible to build it up to a major issue.

—Robert H. Thomas

Toomey's Rule. It is easy to make decisions on matters for which you have no responsibility.

—Jim Toomey, the St. Louis Cardinals

Upward-Mobility Rule. Don't be irreplaceable. If you can't be replaced, you can't be promoted.

Vaughan's Rule of Corporate Life. The less important you are on the table of organization, the more you'll be missed if you don't show up for work.

—Bill Vaughan, The Kansas City Star



Infant Formula

DIRECTOR Joshua Logan writes about how a baby provided the high spot of the film *Picnic*:

When lining up Kansas extras I noticed on one young woman's lap a baby calmly blowing one spit bubble after another. I had never seen a baby look so bored, and I longed to include her in the picnic sequence. Looking through the script, my eyes lighted on the words: "Labor Day speech by Mayor." Oh, now I *had* to have the bubble shot. After some especially pithy remark by the mayor, we could cut to the baby blowing a spit bubble. It would be a kind of visual raspberry.

Cameraman Jimmy Wong Howe lined up a close-up shot of the baby and the operator reloaded the camera so as to have plenty of film. The mother assured us that the baby would blow bubbles all day long. The crew set the lights and focus while I watched the baby girl. Bubble followed bubble as though there were a machine inside her.

Being careful not to disturb her mood, we didn't call out or use a clapper to start the shot; it was all done in pantomime. The camera rolled. The baby, however, upon hearing the motor, stopped blowing bubbles and stared at

the camera, fascinated. Her mother was humiliated. She tried to recapture the baby's mood by slithering her finger across the baby's lips.

Jimmy Wong Howe signaled for us to keep on running the film. The film cranked on, and the baby kept on listening to it. Everyone tried to distract her from the camera sound. She was not to be distracted. Three hundred extras, an entire cast and crew waited while we rolled film on a baby girl's eyes looking right into the camera.

A camera has only a thousand feet in one roll of film. The mother slithered her finger over the little girl's lips again, then bounced her up and down—and just before we ran out of film, the baby got bored with the sound of the motor and blew another bubble. And we had it on film. We cut it into the picture during the mayor's speech and got about the biggest laugh I ever got from anything I ever did. It was the high spot of the picnic sequence and was mentioned by many critics as a Logan touch. I am still very pleased when other directors say to me, "How on earth did you ever get that baby to blow that bubble?"

—*Movie Stars, Real People and Me* (Delacorte)