

THE BIG BANG!

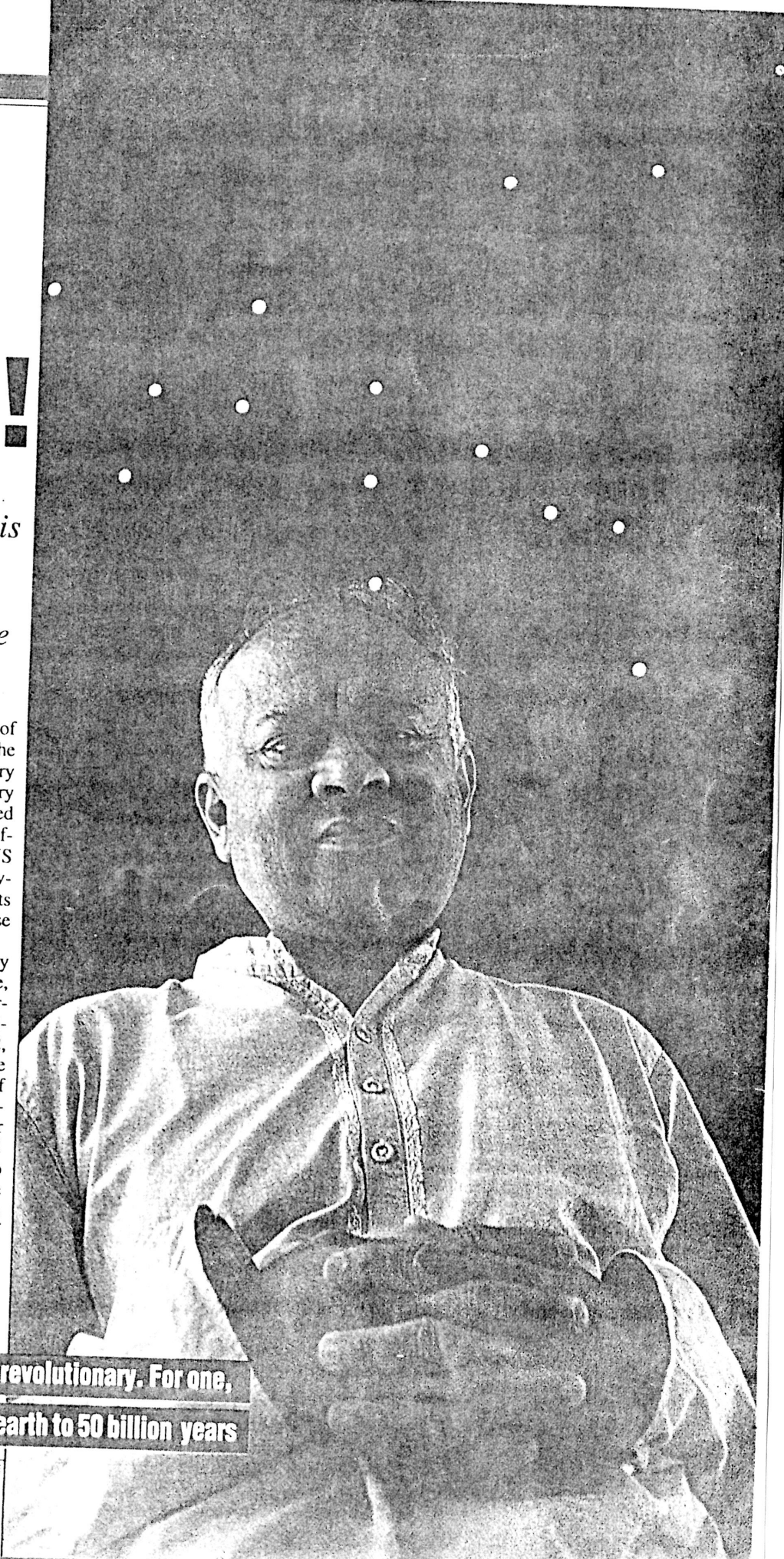
Indian cosmologist Jayant Narlikar and his associates come out with a new theory about the origins of the universe

Three cosmologists, one of them an Indian, are on the verge of rewriting the history of the universe. The legendary British cosmologist, Fred Hoyle, India's Jayant Narlikar and Geoffrey Burbidge, the California-based US physicist, have come very close to solving the riddle that has baffled scientists through the ages: how was the universe created?

Scientists the world over, especially cosmologists who study the universe, are rapidly turning to "God" in their search for the answers to the secrets of the origin of the universe. On 23 April, 1992, they proclaimed that they had seen "the face of God" and that they had proof of "the creation" when reports from a satellite—the Cosmic Background Explorer (COBE) launched by the National Aeronautics and Space Agency to study the universe—confirmed that the scientists had been right all along in believing that the world was born out of a huge explosion popularly known as the Big Bang.

However, less than two years after the sensational discovery, the scientists are no longer so sure. And ironically

Jayant Narlikar's findings are revolutionary. For one, they push back the age of the earth to 50 billion years



enough, the same COBE satellite has been instrumental in demolishing the Big Bang theory. Now, the limelight has been turned once again on an older hypothesis, called the Steady State Theory (SST).

This battle of theories date back to the early 1920s when Edwin Hubble, a Los Angeles-based astronomer, discovered that all the galaxies in the cosmic system were racing away from our galaxy, the milky way, and in a systematic manner.

Scientists tried to explain this discovery on the basis of the Big Bang theory, which said that the earth was formed when a huge ball of fire exploded throwing cosmic particles into space. And as a result, the galaxies are moving away from each other at a high speed. The theory also states that due to the rapid expan-

THE MAKING OF A SCIENTIST

Astronomy has always been Narlikar's obsession

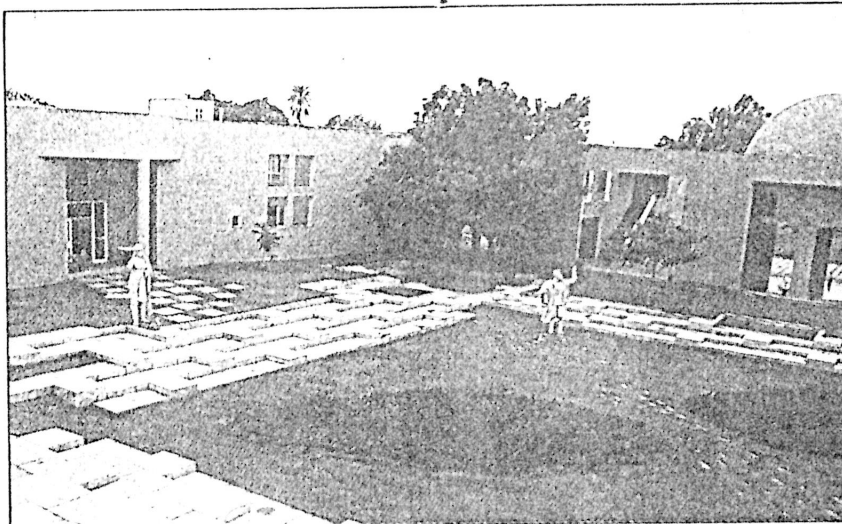
When he reminisces about his childhood, Jayant Narlikar likes to narrate a particular incident that happened in his school days. One day, when he was seven and studying in Standard III, his teacher asked him about his father's profession. Narlikar told him that his father was a professor but was unable to tell what subject he taught. When the teacher told him that his father was a professor of mathematics,

came when he went to Cambridge in 1957 for doctoral studies in mathematics and it was there that he came in contact with the person who would change the course of his life. Narlikar met Fred Hoyle, perhaps the greatest cosmologist of this century. Hoyle stimulated Narlikar's interest in astronomy and later became the guide for his doctoral studies. "When I first went to ask him about the subject of the thesis, he discouraged me from taking up the Steady State Theory (SST) as he thought it was very controversial and fended me off for a while," Narlikar recounts.

Narlikar, however, eventually got a chance to display his grasp over the subject when Hoyle sent him to a seminar where an exponent of the Big Bang theory, Martin Ryle, was going to present his papers demolishing the SST. "When I finished my presentation, I realised that not only did the people get what I was saying, but it also took some of the sting away from Ryle's criticism. And to me, it meant a strong surge in confidence."

This incident brought Narlikar and Hoyle closer and they have been working together since. In 1965, Narlikar met Prime Minister Lal Bahadur Shastri and M.C. Chagla, the then Union education minister, who asked him to return to India. He told them that his work would keep him out of the country for at least seven years more.

In 1972, Narlikar came back to India and joined the Tata Institute of Fundamental Research (TIFR). For the next 16 years, Narlikar worked at the TIFR but kept in touch with Hoyle. In 1988, he set up the Inter University Centre for Astronomy and Astrophysics (IUCAA), of which he is the head till date. •



The Inter University Centre for Astronomy and Astrophysics: Narlikar's brain-child

sion, the universe has cooled significantly over the last ten billion years.

Over the years, the Big Bang theory gained rapid acceptance amongst the scientists, who quickly dumped the earlier SST that had dominated astrophysics till then. When COBE detected some extremely minute fluctuations in the temperature — which reflects the impact that formation of various galaxies had on the universe — George Smoot, a proponent of the Big Bang theory and leader of the COBE team, invoked God.

However, criticism soon followed. The opponents of Big Bang found some loop-holes in the theory. They say that the Big Bang supporters are unable to explain the existence of some stars and

Narlikar was thrilled. Mathematics was his favourite subject, too. "Since that day my respect for my father went up," he says.

Born to the famous mathematician, Vishnu Narlikar, who was pro-vice-chancellor of the Banaras Hindu University (BHU), Jayant Narlikar had his grounding in the subject pretty early. His father had a rich collection of books on various subjects and this generated a lot of interest in young Narlikar. Another big influence on Narlikar was his uncle, M.S. Huzurbazar, who did his M.Sc. and then went on to become a professor at the Institute of Science in Bombay.

However, Narlikar's big break

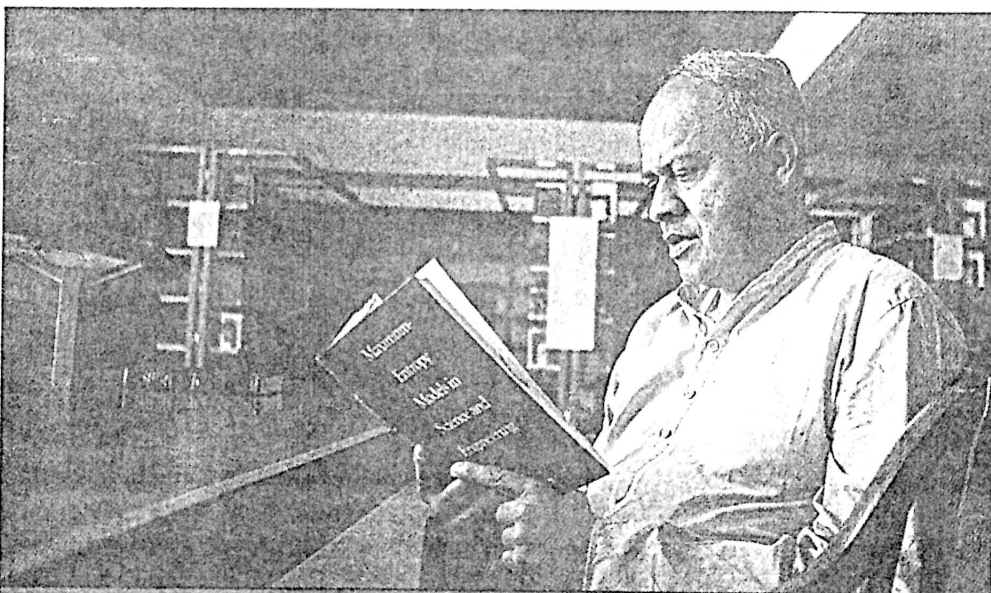
cosmic systems that date much before the ten billion years when the universe was supposed to have been formed. "If this is the 'face of God', then it is inscrutable," remarks Narlikar about the COBE discovery and its interpretation by the Big Bang supporters.

Narlikar and his associates are critical of the Big Bang on several grounds. The first objection is that in this theory you have the universe coming out of nothing which is a violation of the conservation of matter and energy as observed under Einstein's Theory of Relativity. A gaping hole in the Big Bang theory is the age of the universe, which has been put at

around ten billion years. But several clusters on the face of the earth have been spotted which date back to 15-18 billion years. Narlikar estimates that the revised age of the universe is 50 billion years.

The SST that Hoyle, Narlikar and Burbidge are proposing says that in the universe, matter is constantly being created in mini-bangs and this can be explained with the help of a theory that is similar to the Theory of Relativity. These bangs, which normally occur near a massive object, produce a lot of energy and hence the radiation background of the universe, which can be compared to the DNA prints of a human being, is undergoing a continual change.

The new theory also tries to overcome some defects of the older one. For instance, it can now explain the presence of hydrogen and deuterium in the universe which is a result of 'mini-bangs'. It also explains the temperature of the radiation background. The team has already printed three papers on the new theory in leading science journals in June 1993, August 1993 and April 1994. The fourth



GAUTAM PATOLE

Although scientists believe in the Big Bang, they are beginning to give a thought to the new hypothesis propounded by Narlikar and his associates

and concluding part of the paper is due to be published soon. And that is when the real battle will begin for Hoyle and his team.

Though the new theory has obvious advantages over the Big Bang, it is not going to be an easy task for Narlikar and his associates to convince the scientists. The Big Bang proponents are extremely arrogant and they refuse to even consider any alternatives to their theory. "We must realise its limitations but we find the proponents of the Big Bang theory to be dogmatic," says Narlikar. Chief

among the Big Bang proponents are Jim Peebles of Princeton University and David Schramm of the Chicago University.

There is yet another problem. As Narlikar explains: "Since funding of scientific projects is influenced to a large extent by the leading scientists, most of whom are conformists, any proposal for research on a non-conformist theory is at a disadvantage immediately."

However, of late, the world community has been more accommodative towards dissent, says Narlikar, "The majority still believes in the Big Bang but at least, people are beginning to listen to us. Even two years ago, this was unimaginable."

BIG BANG VERSUS THE STEADY STATE THEORY

- The Big Bang theory states that the universe was created out of a massive explosion
- The age of the earth is approximately 10 billion years
- The earth has cooled significantly and there are no more explosions taking place
- The SST says that it was not a single explosion that created the universe, but a series of mini-bangs
- The age of the earth is around 50 billion years
- Mini-bangs are continually taking place according to the supporters of this theory

The impact of the new theory, if accepted, can transform cosmology as we know it today. It will dramatically increase the size and age of the universe by at least 100 times. And it will surely catapult Hoyle and his team to the centre-stage of scientific studies and make them strong contenders for the Nobel Prize. But Narlikar prefers to be modest. "Real satisfaction comes from the acceptance of the idea," he says. •

Ranvir Nayyar/Bombay