

ASTRONOMY

Birth of Our Solar System

Dust Cloud theory suggests that planets were created following the collapse of an enormous cloud of cosmic dust and gas.

By MARTHA G. MORROW

► BEING in a fog will help you understand science's latest explanation of how the sun and its system of planets—including the earth—were born.

Imagine yourself high on a mountain top, completely lost in a vast cloud. Suddenly the supersaturated atmosphere condenses and rain begins to fall. Tiny droplets of water spatter at your feet.

But occasionally a gust of wind catches the falling drops. They are carried upwards, away from the earth.

Billions of years ago currents such as this may have kept the cosmic dust and gas from which the earth and other planets were being formed from falling into the center, destined to become the sun.

The complete collapse of a stupendous cloud of cosmic dust and gas some 5,500,000,000,000 miles across, but of about the same mass as our sun today, was responsible for our solar system. This is the suggestion of Dr. Fred L. Whipple of Harvard College Observatory. Our expanded sun probably did collide with other partly-formed clouds, he believes, but at a very early stage in its creation.

Subclouds Were Active

At first the entire system whirled but little, if at all. But the smaller subclouds within it were not so quiet. They moved in parabolic paths and were continually sliding by or bumping into one another.

Then slowly the cloud began to collapse. Many millions of years passed before it completed even the first stage of contraction. But as the cloud became smaller, it shrank in size at a more rapid rate. The cosmic dust and gas became concentrated at its core, they grew hot and began to glow.

The planets were probably all formed before the cloud contracted enough to fit within the orbit of Mercury, the innermost planet. They may have developed in a smaller cloud of dust and gas captured by the large cloud. Or, more likely, they were created in a dusty gaseous stream within the parent cloud.

As the great cloud shrank, the planets grew in size. Moving about within the parent cloud, they picked up more cosmic matter. Spiraling inwards, they finally arrived at about the same distances from the sun that they keep today.

Because of their common motion about the core of the cloud, the new-born planets continued to move in about the same plane and in the same direction. As they grew larger by picking up more cloud material, their orbits smoothed out and became more nearly circular.

Father of New Theory

The father of this scientific theory of the birth of the solar system is a meteor authority who has a comet or two named after him. One of the group of world-famous Harvard astronomers directed by Dr. Harlow Shapley, Dr. Whipple is an enthusiastic and energetic researcher on the portion of the sky that is closest to our own earth, our own little part of the cosmos.

Man has puzzled for thousands of years over how the earth, its sister planets and the sun were created.

This question today is answered in several ways. For some, the solar system was originally a nebula; for others it was once a star, even a double or triple star. Some astronomers believe the solar system is the result of a stellar accident of gigantic proportions; others feel it developed while the main body shrank as it grew older.

The oldest hypothesis of importance today is that advanced by the German philosopher, I. Kant, who in the middle of the eighteenth century suggested that the solar system was formed from a nebula. The French astronomer P. S. Laplace put this Nebular Hypothesis into scientific terms.

The solar system, according to this theory, was once a slowly rotating nebula that gradually cooled and contracted under the force of its own gravitation. As it condensed, rings of matter split off around the equator and formed planets. These all move in the same direction and have nearly circular orbits, almost in the same plane. What was left gathered itself into a fiery sun.

Although this theory accounted for many of the obvious features of the solar system and was modified to explain others, several outstanding objections remain. An extended tenuous ring of this type could not split off from the slowly rotating nebula and probably could not pull itself together to form a single body. It might form a ring like that surrounding Saturn or a swarm of minor planets or asteroids, but not a planet. Also the major planets have almost all the angular momentum of the solar system—98% of the total.

Another theory, the Planetesimal Hypothesis, was offered about 1900 by two scientists, then at the University of Chicago, the late Dr. T. C. Chamberlin, and Dr. F. R. Moulton, now secretary of the American Association for the Advancement of Science. For them the sun was once an isolated star without planets. But long, long ago another star passed close enough to the sun to tear great masses of matter out of it.

When the other star rushed away, some of the ejected matter fell back into the sun, some followed the star into space, but much of it was left circulating about the sun in elliptic orbits. The planets, which grew as they picked up more cosmic material, are mute evidence of the collision.

Tidal Theory Differs

Details of what happened after the celestial accident differ in the Tidal Theory offered by two Englishmen, Sir James Jeans and Dr. Harold Jeffreys. They agree that material was forced from the sun by another star either approaching the sun close enough to raise great tides on it or actually sideswiping the sun as it rushed past. But they conclude that the matter drawn out of the sun formed an elongated stream or cigar-shaped filament which broke up crosswise. These bodies from the start were nearly as massive as the planets today.

But astronomers were not entirely satisfied with this theory either. A serious dynamical objection was raised by Dr. Henry Norris Russell of Princeton University Observatory who figured out that most of the material ejected from the sun would be dragged to much smaller distances than the planets' present orbits and would be left revolving much less rapidly than is the case today.

Hot gases drawn out into a gigantic filament by such a glancing encounter between stars would explode just as a deep sea fish bursts when brought to the surface and released from the high pressure surrounding it, reasoned Dr. Lyman Spitzer, Jr., also of Princeton. Instead of forming solid bodies like the planets, his calculations showed, a stellar encounter would simply produce an extended gaseous nebula around one or more of the stars involved.

Theory Under Fire

As you would expect, critical astronomers are already trying to puncture holes in the new Dust Cloud theory, tentatively suggested about a year ago. During the last year it has been further developed, and many details cleared up. Today Dr. Whipple spends much of his spare time dreaming and figuring out ways to make the hypothesis answer all questions.

The planets, he elaborates, were given a final "bath of flame," just before they developed as we know them today. This was particularly true of Mercury and Venus, nearer the sun than the earth.

This intense heat probably lasted only a few years. But during this time it burned up whatever atmosphere may have surrounded Mercury and Venus, and dried out much of that on the more

distant planets. Those nearer the sun, particularly Mercury, also probably shriveled up through loss of considerable matter as well as atmosphere.

The earth had long ceased to be gaseous when it was submitted to this intense heat. A completely gaseous earth could probably not have survived. Instead it probably was molten during this phase of its development.

As more is learned about the universe around us, the greater will be our knowledge of how our own solar system was born. When we look at one of those small, dense dust clouds that fascinate Dutch-born Dr. Bart J. Bok of Harvard Observatory, we may be watching the birth of another solar system. When Dr. Spitzer figures out another step in the process by which individual atoms stick together to form minute solid particles, he may be explaining how our own solar system began.

Exactly what happened 2,000,000,000 to 3,000,000,000 years ago, when our solar system was created, may not be known during our lifetime. The Dust Cloud theory probably isn't the final answer. But it may be another stone in the path that leads to a completely satisfactory theory. An explanation of the evolution of the solar system is itself slowly being evolved.

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animals' skin. At the time of the report it had been given to 85 cholera patients in 27 villages.

Giving the drug to other residents of the villages kept them from becoming infected. The Indian scientists emphasize the importance of this preventive aspect of the drug in addition to its curative value.

Development of this new anti-cholera drug started with a finding of Dr. Bhatnagar's in 1939. This was that cholera germs were killed in the test tube in less than half an hour by a 10% solution of hexa-methylene-tetra-amine in normal salt solution. Further studies, although interrupted by the war, led to developments of hopeful compounds made by linking hexamines to a sulfa drug.

"A chance conversation with the scientific department of Ciba," the Swiss drug manufacturing house at Basle, the scientists report, led to the Swiss firm developing the compound now known as "6257."

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AGRICULTURE

World Food Crisis Eased FAO Committee Reports

➤ THE hungry world is not suddenly going to be well fed, but there seem to be fair indications that it will not have to pull its belt in quite so tight in 1948 as it did in 1947. The report of the International Emergency Food Committee of FAO lists three developments, unforeseen six months ago, that have eased the world food crisis "and warrant cautious optimism for the future." They are:

1. An unusually mild winter in Europe;
2. Record harvests in Australia, which

MEDICINE

New Drug Checks Cholera

This sulfa drug, known as "6257", is a powerful killer of cholera germs. It also protects the healthy from infection, Indian scientists find.

➤ A NEW sulfa drug that cut cholera deaths from more than 60 to only four per hundred cases is announced by four Indian scientists in the journal, *Nature*, (March 13). The scientists are Drs. S. S. Bhatnagar, F. Fernandes, J. De Sa and P. V. Divekar of St. Xavier's College, Bombay.

The drug is known as "6257" for short. It is a condensation product of two molecules of a sulfa drug, 2 p-aminobenzene sulfonamidothiazole, and three molecules of formaldehyde.

Preliminary tests showed that it was a powerful killer of cholera germs in the test tube. When injected under the skin of mice it gave 100% protection against cholera.

It was then tried in patients in the

Tanjore District of South India where there were cases of Asiatic cholera in many villages. The patients were treated in their homes without any other medical aid. Most of them were under-nourished women and children who had been vomiting, having diarrhea and suppression of kidney function.

Vomiting was invariably stopped and the diarrhea much reduced within six hours after treatment with the new sulfa drug was started. Kidney functioning was restored by the ninth hour. By the fifth day, the cholera germs were absent from the body wastes. The drug was given by mouth morning and evening for five days, although when given by mouth to the mice it had been less effective than when injected under the

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