

Dr. Harold Urey presents new theory on earth evolution

April 10, 1972

On Tuesday, April 11, 1972, Dr. Harold Urey, Nobel laureate and a member (emeritus) of the faculty of the University of California, San Diego will present a paper before the 163rd national meeting of the American Chemical Society, in Boston. A release based on the content of that paper is attached.

Please observe release time and date: P.M.'s Tuesday, April 11.

Dr. Urey's formal title at the University is "University Professor, Emeritus." "University Professor" is a special, high-level appointment, presently shared by only five professors throughout the University of California's nine-campus system.

The earth may have been formed by the coming-together of some 80 or more moonsized bodies early in the history of the solar system, according to a new theory on the evolution of the solar system proposed today by a Nobel laureate chemist on the University of California, San Diego faculty.

Dr. Harold Urey, winner of the Nobel Prize for his work on heavy water and an authority on the moon, told a meeting of the American Chemical Society in Boston today he now believes that our solar system once contained many bodies as large as the moon, and that these objects accreted, or came together, to form the earth and other planets.

"Various lines of evidence now are available which would indicate that lunar-sized objects existed in appreciable numbers in the early history of our solar system," Urey told the ACS meeting. "The evidence seems to suggest that these objects were a phase in the development of the system. In our solar system today, there is a class of objects that are of that size - seven of them, in fact - including, in addition to the earth's moon, the four moons of Jupiter, one moon of Neptune, and one of Saturn. Also, it is possible that Pluto is an escaped moon of Neptune, whose mass is very inaccurately known. I submit that their existence is no chance affair.

For further proof of his theory, Urey points to the fact that the axes of many planets in the solar system are tilted at an angle from the vertical to the ecliptic, or plane of the sun's path.

"If the earth and some of the planets whose axes are thus tilted had been formed of small objects," said Urey, "I would expect that the axis of rotation in each case would be pointed straight up and down in relation to the ecliptic. But they are tilted off at some strange angle in the case of earth, Mars, Saturn, Uranus and Neptune. Jupiter is an exception.

"However, if lunar-sized objects collided with these planets in their formative stages, the energy of a collision of that magnitude would throw their axes out of alignment. "

In Urey's reconstruction of the solar system's evolution, the following steps occurred:

- The solar system began as a great mass of gas. As this mass began to contract, the sun started to form at its center.

- When the sun had contracted to an equatorial radius somewhat larger than the orbit of the planet Neptune, it began to throw off gas and solids at its equator. It continued to contract, and to throw off gas and solids, until it reached approximately its present size.

- While the sun was contracting, a flat, disc-like circle of gas - the solar nebula - formed around it. Solids thrown off by the sun began to accumulate in this nebula, and the process of planetary evolution began. Smaller solids came together to build a countless number of lunar-sized bodies. These then came together - by collision - to form, in turn, the planets. Some of the moon-sized objects were not involved in the formation of planets, and seven of them remain today in the solar system as satellites of the planets.

"In some cases, the moon-sized bodies may have collided and broken into fragments," said Urey. "Some of these fragments later fell into the planets, while still others may be the little moons we know today around Jupiter and Mars, for example, or the fragments we know as asteroids, meteors and meteorites.

"After taking into account all the lunar-sized objects and the planets in the solar system as we know it today, all of what's left - the asteroids, meteors and meteorites - make up a mass which is only a fraction of the mass of our moon. So most of the primary material accumulated to form these early lunar-sized objects, and these in turn accumulated to form the planets, with the seven exceptions already noted."

- At some point in time, the sun exploded. The enormous energy generated by this cataclysmic event blew most of the free gas and solid matter out of the solar system. The blast "flushed" the solar system of everything except the planets and their satellites, the asteroids and other smaller bodies, and the gaseous envelopes around larger bodies which had enough density to hold these gases by gravitational force. This left the solar system as we know it today, according to Urey.

There may have been several such explosions of the sun during the early evolution of the solar system, Urey said. Similar gigantic bursts of luminosity have been observed by contemporary astronomers as coming from T-Tauri stars, Urey said. Following such a burst, our sun - a rather ordinary star - may have had a luminosity 100 times as brilliant as its present brightness, he said.

Planetary development began at the outer edge of the solar nebula first, according to Urey. The planet Neptune, next to the planet Pluto in distance from the sun, probably was formed first from the raw material then being thrown off by the contracting sun. (Pluto, in Urey's theory, probably is an escaped moon of Neptune, hence probably was not the first body formed in this process.) As the sun contracted further, Uranus - next to Neptune in distance from the sun - was formed, and so on, until all the solid materials and gases thrown from the sun were used up and the sun had reached its present diameter.

If the solar system evolved according to his model, said Urey, it was a highly inefficient process.

"The solar nebula apparently had a mass equal to about two-tenths or more of the mass of the sun. This is much more than the collective mass of all the bodies now in the system, the sun excepted.

"If theories advanced by certain scientists are correct, only about one percent of the material which made up the original solar nebula was left behind, in the form of planets, asteroids and so forth. The rest was blown out of the solar system. Of what's left, the planet Jupiter makes up about two-thirds. The rest of the planets and all the other bodies put together make up the other third."

Earth's moon is only some 1/81st the size of the earth. All the rest of the "celestial debris" in the solar system - asteroids, meteors and meteorites comprise a mass perhaps one-fifth that of earth's moon, "a relatively insignificant fraction of the whole," Urey observed.

Urey has submitted his research to "The Moon," a learned journal, for publication.

(April 10, 1972)