

PHYSICS

New Orderliness in Nature; Liquids Have Hidden Structure

New Theories of Origin of Universe Also Discussed At Physical Society Meeting; Gravity Force Lessens

A HIDDEN "structure" has been discovered in splashy, fluid water and other liquids, it was disclosed at the meeting of the American Physical Society at the University of Chicago. The seemingly formless nature of fluids, which enables them to take over the shape of any vessel containing them, is only a mask behind which hitherto unknown arrangements of atoms are in action.

Two reports show how physicists are unwrapping this cloak from discoveries pointing to a previously-unknown orderliness in nature.

Prof. G. W. Stewart of the University of Iowa described his investigations of very dilute solutions of such salts as sodium chloride and potassium chloride.

Using a special kind of scattering of X-rays, known as diffraction, Prof. Stewart was able to compare the "structure" of these solutions with the "structure" of pure water and to note the differences created by the addition of the salts.

Using different materials but essentially the same X-ray method, Prof. Frank H. Trimble of Northeast Missouri Teachers College and Prof. Newell S. Gingrich of the University of Missouri confirmed reports of a new type of atomic "structure" in liquids.

Liquid sodium was the material chosen for study. It was found that with increasing temperatures the concentration of atoms about any one atom was much less than for lower temperatures. As expected the increased temperature tends to destroy this new kind of "structure."

Prof. Peter Debye, famed German chemist who has won the Nobel Prize, has declared that liquids are much more closely related to solids than they are to gases because of certain similarities between this new type of "structure" and the structures of solids.

Seek New Theories

Scientists are seeking some better explanation of the origin of the universe than the present-held idea that a tremendous, primeval explosion sent its parts flying off into space.

Under this expanding universe concept, the universe was likened to a giant soap bubble that started spreading in a catastrophic explosion billions of years ago. This rushing-apart of the universe, it was said, has been going on ever since.

A strange shifting of the light from the distant nebula toward the red colors was the observable fact which led to this expanding universe concept, advanced by the Belgian scientist-priest Abbe LeMaitre. This so-called "red shift" was interpreted as being caused by the rushing away of these distant members of the stellar universe. The idea was analogous to the lowering of pitch of a train whistle as it shrills while rushing away from the observer.

Astronomers throughout the world and particularly the scientists at Mt. Wilson Observatory with their great 100-inch diameter telescope supplied the bombardment of observable fact which has led to a search for a better theory than that of a universe in rushing expansion.

Must Be Larger

Dr. Edwin C. Hubble, Mt. Wilson astronomer, recently pointed out that something had to be done, for if the red shift of the light from distant nebulae was correct, the Mt. Wilson instrument was looking out into space nearly to the limits of the universe. Why this conclusion was arrived at is a whole separate and complex story which need not concern us here. The point is that astronomers cannot believe that they are now looking to the limits of space.

The alternative which Dr. Hubble suggested was that, perhaps some yet undisclosed new principle of nature was operating. Since Dr. Hubble's report, scientists have been seeking to interpret the red shift in other ways.

Prof. Arthur Haas, Austrian theoretical physicist now at the University of Notre Dame, recently offered one alternative picture by suggesting that the observed red shift might be explained if light rays became weaker in energy—became tired, in effect—in their journey over millions of millions of miles and

millions of years of time from the distant nebulae to the astronomer's telescopes on earth.

At the Physical Society meeting, Prof. Haas described calculations showing that the dilemma of the red shift could be circumvented if the total mass in the Universe were increasing with time. An increase in mass, for each second of time, amounting to 100,000 times the mass of the sun would solve the difficulty.

This concept of a universe continually growing heavier is one conclusion, said Prof. Haas, of a new theory of the universe which was proposed several months ago by the English physicist, Prof. P. A. M. Dirac, who has won the Nobel Prize for his mathematical achievements in the realm of physics.

Great Ratio Squared

Prof. Haas added that the basic hypothesis of Dirac's theory is that the total number of primordial particles of matter in the universe is equal to the square of the ratio of the radius of the universe to the radius of the electron. The ratio is an enormously large number, for the radius of the universe is about the largest imaginable number which has any real meaning and the radius of the electron comes close to being the smallest imaginable number with equal real meaning. And the square of this ratio, of course, is enormously larger.

Prof. Haas showed that Dirac's assumptions may be deduced from simple and plausible principles which seem to be basic in the physics of the universe.

Equally ingenious in seeking to find some new and yet-undetected principle of nature was the suggestion of Ira M. Freeman of Central College, Chicago.

Mr. Freeman suggested that the force of gravity decreases gradually through the ages and ages of time during which the universe has existed. If this starting concept really exists it means that the pull of everything in the universe for everything else becomes less as the ages of time roll on. This is like saying that a stone weighing 100 pounds now will weigh 99 pounds in a billion or so years. And the decrease in weight, it must be explained, is not caused by weathering or any factors other than the dwindling of the force of gravity.

Mr. Freeman's idea is said to account for the reddening of the light from the most distant nebula. But scientists will probably wish to give it much thought before accepting it.

Scientists studying the still-mysterious and piercing cosmic rays which continually strike the earth and everything on it, from the depths (*Turn to Page 366*)

lus. Vaccine of the Saranac Laboratory contains a virulent bovine tubercle bacillus, but is killed.

Dr. Kinghorn hopes that this caseous vaccine, when perfected, will be of decided value in preventing the development of tuberculosis in young children who have no tuberculosis.

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of outer space, are adventurers. They have climbed rugged mountain peaks, carried their instruments high into the stratosphere in balloons, sailed the seven seas and sank their equipment deep in lakes.

Now, it is disclosed at the meetings of the American Physical Society that they have donned miners' crash-helmets and carried their delicate measuring apparatus into deep mines.

V. C. Wilson of the University of Chicago reported to the physicists' meeting his experiments carried out in a mine in Michigan to a depth of 1600 feet.

The mine chosen had its shaft slanting at 34 degrees to the vertical so that by placing the instruments at different places along the shaft any thickness of rock could be studied for its absorption of the rays.

At the maximum depth of 1600 feet it was found that the piercing radiation still came through the great rock mass. Its value, however, was only one twenty-thousandth of the intensity at the surface.

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Short-wave radio sets have proved so useful in emergency communication in U. S. National Forests that 2,300 sets are in use.



Insect Specialists

SOME flowers insist upon the attention of specialists for accomplishing their pollination.

Not many, to be sure: the vast majority of flowers have open, easily accessible nectar and pollen stores, so that the ubiquitous honeybee and other insects of about the same size and lack of specialization can visit them and perform this vital service toward the production of fruit and seed. Apple and alfalfa, orange and white clover, buckwheat and tulip-tree, a wide variety of others, find the "old family bee" quite adequate.

But there are some flower forms that have become so highly specialized that only a correspondingly specialized insect can be of any use to them.

Particularly is this true of flowers with very deep, narrow throats, like tobacco, petunias, and certain species of lilies, like the beautiful white Madonna lily. The insects that can most successfully pollinate these are certain species of hawk-moths—those big-bodied, whirring-winged moths that some persons mis-

take for hummingbirds. Hawk moths have tongues so long that usually they never touch the flowers with their feet—just hover with their heads partway into the tube, and thrust that incredible proboscis down after the nectar. And, incidentally, daub their heads and bodies with pollen, to be carried to the next flower they visit.

Hawk-moths are so important to one of our major commercial crops, tobacco, that if their numbers were seriously reduced—say by the eradication of the weeds their big, fat caterpillars feed on, it would be necessary to begin the cultivation of special patches of food plants for them.

Bumblebees are another important group of long-tongued insects essential to the welfare of an important crop, this time red clover. Breeders have been trying to get a short-flowered red clover that honey-bees can pollinate, but bumblebees still remain a heavy standby to the red clover seed crop.

Charles Darwin is credited with a classic ecological chain, proving that old maids are necessary to the clover crop. Something like this: Old maids keep cats. Cats kill field mice. Bumblebees find good nesting-places in the empty mouse burrows. The more bumblebees the better the clover crop. Q. E. D.

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removed, during earlier museum collecting expeditions:

"The specimens that have been removed from this quarry represent eleven genera of dinosaurs, mostly gigantic sauropods, also crocodiles, turtles, and a lizard; and we have reason to believe that other genera are represented in this accumulation.

"The bones are unusually well preserved and but little crushed. It is a veritable Noah's Ark of animal remains characteristic of the Jurassic Period.

"Here are skeletons of the largest of the sauropods mingled with the skeletons of powerful but smaller flesh-eating dinosaurs, the heavily armored forms like *Stegosaurus*, as well as the smaller bird-like dinosaurs. Intermingled with these are an occasional turtle-shell, crocodile remains, fresh-water shells, cycads, fossil leaves, and wood fragments."

All on a tilted table 190 feet long and 30 feet wide—a dainty dish to set before an interested public!

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