

SCIENCE NEWS

Science Service, Washington, D. C.

THE SIZE AND SHAPE OF THE UNIVERSE

WHAT is the size of the universe and what is it like in its shape? Dr. Edwin P. Hubble, of Mount Wilson Observatory of the Carnegie Institution of Washington, proposed two answers in a lecture in Washington on January 5, on the topic "Our Sample of the Universe." From studies with the world's largest telescope now in use—the Mount Wilson 100-inch-diameter instrument—the observable portion of the universe is now a giant astronomical sphere with a radius of 400 million light years.

Studies so far made seem to present a choice of two kinds of universes: (1) a small expanding universe which is finite in extent but unbounded and (2) a universe indefinitely large that is not expanding appreciably but which contains some unknown principle of nature. The explanation chosen to account for the observed reddening of the light from the most distant nebula fixes the choice of these two alternate points of view. If the reddening, or red-shift, so-called, is considered due to the expansion of the universe, then a curvature in space has to be brought into the picture to account for the observed density distribution. Otherwise the density of distribution would increase outward systematically in all directions and our own stellar system would be left in a unique position. At the present time, the curvature is positive and very large, so that if the red-shifts measure expansion then the universe is finite in size and very small. In fact the present radius of spatial curvature would be just less than the present penetrating power of the 100-inch reflector.

Of the alternative concept of the universe's size, Dr. Hubble indicated that if the red-shift is not due to expansion but to some yet unknown principle of nature which does not involve actual motion, then the true distribution of nebulae is sensibly uniform. And since the observable region is homogeneous, the universe, presumably, is so vastly greater than the observed sample that no positive inferences can be drawn. Thus a choice is offered between a small expanding universe and a universe of immense but unknown dimensions plus a new principle of nature. It is possible that the theory (expanding universe postulated by Abbé Lemaitre) may be generalized to include new models. Otherwise, the probabilities, at the moment, seem to favor the greater universe, although a definite choice will doubtless await more powerful methods or still greater telescopes.

LIFE AND MAGNETISM

THAT human life is in some way bound up with the great force of magnetism has long been a speculation. "Personal magnetism" is a pseudo-scientific phrase which shows one form of this type of speculation. At the recent conference at Princeton University on molecular structure, a true scientific basis for linking magnetism and life was discussed. And the link appears to take place in the blood and makes possible the body's respiration.

Dr. Worth H. Rodebush, of the department of chemistry of the University of Illinois, told of the rôle the magnetic property of oxygen plays in life. Oxygen supports respiration by permitting the oxidation of the blood's impurities at relatively low temperatures. But if it supported all forms of combustion as it does respiration the whole world would shortly burn up, for all dry organic matter would quickly be consumed. Something of the paradoxical behavior of oxygen is shown by its position in the periodic table of the chemical elements, where it stands between the inert gas nitrogen, on one hand, and the extremely reactive gas fluorine, on the other. Oxygen, in other words, has a considerable amount of chemical activity and affinity and yet not too much. A possible clue to the paradoxical behavior of oxygen is found in the fact that, of all the common elementary diatomic gases, oxygen alone is paramagnetic, gathering in a magnetic field, and hence reacts readily with other magnetic materials, such as the iron in the hemoglobin of the blood. Because of the magnetic characteristic of oxygen it does not react so readily with the non-magnetic substances like cellulose and the hydrocarbons. And thus spontaneous combustion does not occur at ordinary temperatures. Yet within the human body, the reaction between oxygen and hemoglobin, by which the impurities in the blood are burned, takes place readily without raising the temperature above body heat.

SPRAY-CONTROLLING LAWS

ALL apple-growing states should have their own state laws to protect resident apple eaters from the dangers of poisonous spray residue. Recommendations for such legislation appears in a research report in the current issue of *Public Health Reports*, official publication of the U. S. Public Health Service. The recommendation for spray control legislation by states is made by Dr. Ralph Heeren, of the University of Iowa.

Investigating the poison spray residue situation in Iowa, Dr. Heeren and his associate, Helen B. Funk, found that fruit from some orchards had spray residues definitely higher in amount than the safe limit set by the U. S. Department of Agriculture. This limit is 0.018 grain lead residue per pound of fruit. Samples from some of the orchards gave values as high as 0.024 and 0.027 grain per pound of fruit. Most samples, however, yielded lower values than the 0.018 safety limit. If the lead residue is higher than this limit, government scientists believe there is enough lead in arsenic on the fruit to be "potentially dangerous to the consumer."

Sprayed fruits and vegetables shipped in interstate commerce are subject to federal inspection. Fruits and vegetables sold within the state where they are grown are without this safety control and only a few states have laws of their own pertaining to regulation of amounts of spray residue. It would appear that all apple-growing states should enact laws giving the state department of health

power to protect consumers against spray residues by controlling amounts of lead present on fruit offered for sale. As a further precaution all sprayed fruits should be washed in a one per cent. hydrochloric acid rinse which has been shown to be an effective and simple means of reducing lead loads.

REPORT OF THE AERONAUTICS COMMITTEE

POINTING with pride to the present remarkable development of American aviation, founded upon fundamental scientific research, the National Advisory Committee for Aeronautics in its report to President Roosevelt, transmitted to Congress on January 11, urges the wisdom and ultimate economy of increased research appropriations to insure that this country shall not fall behind. "Commercial aeronautics is more highly developed in the United States than in any other country," the report states. "Military aircraft developed in the United States are highly efficient and dependable."

Major European nations are placing tremendous emphasis on the military significance of aircraft. Their construction programs and factories are being enlarged and research laboratories and facilities multiplied. While the National Advisory Committee for Aeronautics laboratories at Langley Field, Va., are on the whole as yet unexcelled by those of any other single nation, the maintenance of American leadership becomes more difficult in the face of tremendous expansion of research facilities by foreign nations. Because the large seaplane is becoming an important factor in the development of transoceanic air transportation and of long-range naval aircraft, the present National Advisory Committee for Aeronautics seaplane towing tank of 2,000 feet length is having approximately 900 feet added to it. It will then accommodate water speeds of up to 80 miles per hour. A large pressure type wind tunnel is also being built. By increasing the pressure in the tunnel to three or more atmospheres, relatively large models can be tested under conditions that will give results more nearly corresponding to the actual performance of large airplanes flying at high speed than it is possible to obtain in any wind tunnel in the United States at this time. The new 500-mile-per-hour wind tunnel placed in operation during the past year has more than met its designed performance.

Regular seaplane service across the North Atlantic will soon be inaugurated, the report predicts. It also observes that the economic status of air transport is improving to such an extent that cargo airplanes are being developed for freight only.

AVIATION ENGINEERING AND MOTOR BUS DESIGN

A NEW light-weight motor bus, designed, engineered and built by aviation personnel, seized the spotlight of discussion at the Detroit meeting of the Society of Automotive Engineers. The economies achieved with these motor coaches in experimental operation promise to greatly increase borderline profits with heavy, present-day equipment.

The achievement of the new coaches after several hun-

dred thousand miles of operation are: gasoline mileage cut in half for an ordinary coach of similar seating capacity; tire mileage of 60,000 miles a set, and brake lining lasting 40,000 miles.

The new buses, which bring a clean break with automotive conception of engineering and apply the lessons learned by aviation, were conceived by William B. Stout. They were described at the technical sessions of the Society of Automotive Engineers by Stanley E. Knauss, of the Gar Wood Industries, Inc., of Detroit. To get rid of vibration, noise, heat and odors for the passengers the new coach has its engine in the rear. And it has special springs instead of truck springs now in use which tend to give a truck ride. A twenty-four passenger bus weighs only 6,500 pounds because its framework is of metal tubing, welded throughout. The light weight permits smaller power plants to be used and the auxiliary transmissions and clutches which are readily available by present mass-production techniques. Repair shops for such motors are plentiful and the bug-a-boo department of most bus operators—the stock room—can virtually be eliminated.

APPLICATION OF MACHINERY TO THE FARM

MECHANIZATION of the farm as one of the basic factors in the growth of America was a topic at the Detroit meeting of the Society of Automotive Engineers. Harry G. Davis, director of research of the Farm Equipment Institute, Chicago, showed that in 1820 it took 83.1 per cent. of all workers in the nation to operate the farms. In 1900, after animal-powered farm machinery had been perfected, it required only 35.5 per cent. of the workers to operate the farms. In 1930 only 21.5 per cent. of the workers were needed on the farms, due to the advance of mechanization, particularly in the replacement of the horse by motor power. Whole industries to-day could not exist if the former man power on the farm had not been freed. Thus, internal combustion and Diesel engines in the form of tractors and power plants decreased the needed farm labor a very sizable amount, even when compared with the extraordinary revolution which occurred with the use of machinery like the binder and reaper.

Comparing the figures for change from 1820 to 1900 with the change from 1900 to 1930, it can be shown that in the latter thirty years the impact of motor-driven farm machinery accounted for a decrease of 69 per cent. in the needed farm workers. For those who cry that mechanization of the farm has been a contributor to depression troubles, Mr. Davis pointed out that the elimination of a single machine like the cotton gin would break the nation as it now exists. If we were to do away with this machine and did not reduce our production below the average of the past ten years, it would require 37,000,000 people, working 8 hours a day for 300 days a year, to separate by hand the seed from the cotton lint. About a fourth of the entire population would be needed, therefore, to get out the cotton crop alone. While tractors first came into being to draw farm machinery formerly pulled by animals, the newer trend has been to design both machinery and its power unit as a single coordinated whole. Im-

proved operation and economy has resulted from this move. There are still 3,000,000 farms of 50 acres or more in the United States that could use farm mechanization. And there are a million more which could use more of the newer, smaller models.

ITEMS

UNOFFICIAL reports of influenza outbreaks in New York City, Minneapolis and Chicago have reached the U. S. Public Health Service in Washington, but figures from the entire nation show that there is no general epidemic. For the week ending December 26, the latest for which reports are in, state health officers throughout the country reported a total of only 2,088 cases. This figure may be below the actual total, since influenza is a disease for which it is almost impossible to get accurate reports. New York State outside of New York City, for example, does not collect influenza case reports at all. In the local outbreaks influenza cases are a little higher than usual for this season, but have not reached the high figures of the epidemics of 1928 and 1932. These outbreaks began about the first of December, a fact which makes it seem unlikely that they are the forerunners of a wide-spread epidemic. The history of flu epidemics, it was pointed out, shows that they generally begin as early as October.

INVESTIGATORS at the National Bureau of Standards are searching for some new transparent plastic material which will be strong enough to serve as an airplane windshield for those accidents where a bird flies against it. Another need is for a drinking cup material for use in prisons so that lethal weapons can not be easily obtained as with present heavy crockery.

To protect the eyes of the welder from the blinding light of the electric welding arc, a Lexington, Ky., inventor, H. F. Montague, has invented and just obtained a patent for a new type of fool-proof welder's hood. The instant the wearer of such a hood touches the piece of metal with the welding rod, a protective screen instantaneously covers the window of the hood to filter out the blinding rays that would otherwise reach the welder's eyes. The moment he lifts the rod—stops welding—the screen snaps away from the window so that without tilting or lifting the hood, the welder can inspect the work. Operation of the screen is made automatic by special electric mechanism in the hood, which is controlled by the current that operates the arc.

A DEVICE that automatically records the ups and downs of a bumpy airplane flight has been developed by the National Advisory Committee for Aeronautics, it was reported to the Society of Automotive Engineers. Richard V. Rhode, research engineer of the National Advisory Committee for Aeronautics laboratories at Langley Field, Va., explained the operation and recording of his so-called V-G recorder which shows the simultaneous effect of air speed and the acceleration of gravity during a gusty flight. By an ingenious coupling of levers which activate a stylus rubbing on smoked glass, the National Advisory Committee for Aeronautics recorder gives a permanent record of how the effect of gravity combines with airspeed. In both land transports and seaplanes the

device has now taken records for over 20,364 hours in the air and traveled over 3,500,000 miles in doing it.

At the symposium on molecular structure of matter sponsored by the American Chemical Society at Princeton University, Drs. Walker Bleakney, E. U. Condon and L. G. Smith, of Princeton University, told how electrons may be shot at gas molecules at small velocities and energies equivalent to only 20, 30 or 35 volts and fundamental molecular problems solved. Significance of the research is that: It is primarily concerned with the number of ways in which a molecule may be broken up, the energies necessary for these transformations, and the probabilities of their occurrence. A new discovery in this field is that when a single electron hits a many-atom molecule like benzene—with its six carbon and hydrogen atoms—all the hydrogens may be stripped off. The entire binding force which holds the benzene molecule together is completely overcome by the impact.

IN connection with Science Service report on the Research Parade demonstration of the effects of thymus extract on rats, Science Supplement, December 4th, Dr. Leonard G. Rowntree would like to make the following corrections. The facts are as follows: (1) Preliminary experiments with the injection of pure glutathione indicate that it may produce a similar effect to that of thymus extract on growth and development of the young of the second generation. (2) Glutathione has been detected in our potent preparations of thymus extract. The administration of thymus extract and glutathione was by injection and not by feeding.

CHINCH BUGS are in winter quarters in "moderate to very large" numbers through central Illinois, southern Iowa, northern Missouri and eastern Kansas. Smaller hibernation-numbers are reported across Ohio almost to the Pennsylvania line and south into Arkansas. The bugs live over winter in wayside grasses, ready to migrate to small grain crops as soon as the fields develop in spring. Later, they shift to corn. Whether the bugs will prove the pest next summer they did in 1934 is still an uncertainty. It will depend on the weather, particularly on whether it rains during their times of migration. The bugs are favored by hot, dry weather in late spring and early summer. Wholesale burning of fieldside and roadside grasses is not recommended as a means for getting rid of them. It is not always effectual, and in the long run may do more harm than good by destroying cover needed by wildlife valuable to the farmer. Changes in field planning, especially planting more soybeans and other legumes, which chinch bugs do not touch, are suggested as good control measures.

THE nearly complete fossil skull of an entirely new kind of extinct titan-beast, or Titanotheres, recently found in the Death Valley region of California, is reported to the National Academy of Sciences through its official *Proceedings*, by Dr. Chester Stock, of the California Institute of Technology. The animal's head in life must have been nearly three feet long, for the skull has an over-all measurement of about 28.5 inches. It was found in a geological stratum of Oligocene Age, estimated at approximately fifty million years ago.