SCIENCE NEWS

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DISTANT NEBULAE

LIGHT signals coming from the outposts of the universe take 500 million years to reach the telescopes of astronomers on earth, Dr. Edwin P. Hubble, of Mount Wilson Observatory, said in the first of a series of lectures delivered at Yale University. Light with its super-speed of about 186,000 miles a second, he added, travels nearly six million million miles a year.

The outposts of the universe are the faintest nebulae, or stellar systems, detectable with the giant telescopes now in use. The outposts mark the surface of an imaginary sphere in space which is called the observable region.

As telescopes have become more powerful in their light-gathering ability the observable region of space has become larger. The efforts of astronomers to study larger and larger regions might be compared to a man holding an electric light in a fog. Only a limited region of the fog is illuminated and "observable" for a given brilliance of light. To see a larger region a stronger light must be used.

A stronger light would be a larger telescope in this analogy, not because it shines out in space and illuminates more of it, but because it has a greater ability to gather what light exists in space and focus it on photographic plates.

Within the "observable" region of space, Dr. Hubble indicated, it is now probable that there exist some 100 million nebulae like the one of which the sun and earth are tiny parts. A study of the distribution of these nebulae shows that on the average they are two million light years apart. If one could mentally shrink each nebula (which is 10,000 light years in diameter) to the size of a tennis ball the next nearest nebula, on the average, would be about fifty feet away.

The observable region of space so far studied, Dr. Hubble said, has been found to be what astronomers call homogeneous and isotropic. That means simply that it is pretty much the same everywhere and in all directions.

A major problem of astronomy is to determine whether the vast region of the universe now observable with telescopes is a fair sample of remaining space. If it is, the characteristics that have already been found would apply to the universe in its entirety. The new 200-inch diameter telescope being built for the California Institute of Technology will go far in answering this important question.

THEORY OF COSMIC RADIATION

IN an article copyrighted by Science Service Dr. W. E. Danforth asks whether cosmic rays are a sort of super x-ray, *i.e.*, very high-powered "bullets of light," or are they particles of matter bearing electrical charges? Until recent years the former possibility was almost universally favored. The recent journeys of scientists, bearing cosmic ray detectors to various parts of the world and to mountain tops, however, have proved that these projectiles, which pelt down upon us from interstellar space, are affected by the earth's magnetic field. Therefore they must consist, at least in part, of electrically charged particles such as electrons or protons.

A complete theory of cosmic rays, however, has a host of facts to explain. A theory must, for instance, result in a mathematical formula from which the number of cosmic rays at any altitude can be calculated. The appeal to physicists of the "super x-ray" or "photon" theory lay in its success in giving the correct altitude formula. But now that a large part of the cosmic radiation is known to be of electrically charged nature, this success of the photon theory appears illusory.

A new form of charged particle theory, which enables one to explain all of the major known facts about cosmic rays, including the precise way in which their intensity varies with altitude, is propounded in the current issue of *The Physical Review* by Dr. W. F. G. Swann, of the Bartol Research Foundation, at Swarthmore, Pa.

Perhaps the boldest aspect of this theory is the supposition that the original (or "primary") rays continue right through our atmosphere in undiminished numbers until they bury themselves in the earth. But what, the reader may ask, about the fact that on a mountain top there are many times as many rays as at sea level? To this question Dr. Swann replies that nearly all of the rays which affect cosmic ray detectors are not the original primary cosmic rays, but are other electrically charged particles knocked out of atoms by the primary rays as the latter traverse the atmosphere. These secondary rays fly forward with practically the same direction as the primary which produces them. Some energy is lost by the primary every time it produces a secondary.

One of the cornerstones of the theory is the supposition that the number of secondaries produced in a given distance is in direct proportion to the energy of the primary ray. Strangely enough, the theory permits a primary charged particle to be changed into something else, *e.g.*, a bullet of light, once it is within the atmosphere.

THE STRATOSPHERE FLIGHT

OFFICERS of the National Geographic Society are anxiously scanning the daily weather maps hoping for favorable conditions for the take-off of the stratosphere balloon *Explorer II* from Rapid City, S. D.

The expedition, sponsored by the society and the Army Air Corps, needs a "high" area of barometric pressure extending to the east and southeast of the take-off site. The technique is to allow the high area to get ahead of the balloon flight and then ride the "tail" of the high eastward.

The gondola and its equipment will be a ton lighter than in the flight originally scheduled for last summer. The 2,000-pound cosmic ray apparatus of Professor Robert A. Millikan will not be carried.

Other changes in the flight include a new design for ripping the balloon fabric in an emergency. No rip

panel will be employed, since previous failures of the upper balloon fabric have been traced to the possible weakness inherent in rip panel design.

Instead a steel cable will be securely fastened to the outer surface of the balloon near the catenary band. This cable extends to the top of the balloon and then goes down inside through a special, strongly-reenforced hole less than a half inch across. Inside the balloon the steel cable joins a stout rope which comes down and out through the bottom of the balloon bag near the gondola. One sharp jerk on this rope will rip the whole upper fabric and allow an emergency, rapid descent.

The steel cable system is not a new technique but has already been used in airship construction. It is believed, however, that it is the first time it has been applied to a balloon.

Cold weather and snow have been experienced recently at the take-off site. A survey of the weather records of the site for the last 33 years discloses that in October on the average there should occur two perfect days for an ascension, and two others classed as nearly perfect.

NOISE RATING ON MOTOR VEHICLES

ON and after August 1, 1936, all new motorcycles, trucks and private motor cars in Great Britain should be made to pass a noise test before being sold. This is the recommendation of the committee on motor vehicle noise recently appointed by the Minister of Transport, the Hon. Leslie Hore-Belisha.

After a year of study the committee gave the private motor car, except when going over 50 miles an hour, a clean bill of "health" as far as noise is concerned. "Except when running at excessive rates of speed the present-day motor car can not be regarded as unduly noisy."

Membership of the committee included such investigators on sound as Sir Henry Fowler and Drs. G. W. C. Kaye and H. J. Gough, of the National Physical Laboratory.

Realizing the impossibility of studying old and used motor cars in varying degrees of degeneration the committee concentrated its noise studies on new vehicles as delivered from the factory.

Motorcycles, much more commonly used in England than in America, were found to be the greatest offenders in regard to noise. New machines operating on level ground at maximum speed produced a loudness rated at 105 decibels, equivalent to the noise of a busy boiler shop. Even at 30 miles an hour many of them had an unenviable noise rating of 95 decibels—equal to the noise of a riveting machine or an elevated train.

At 30 miles an hour, for comparison, a private motor car was rated at only 85 decibels. Besides clearing the private motor car as a noise menace the committee's findings included: "A number of sports cars are at present too noisy but could clearly be brought to the more acceptable level of the remainder of this type. Except at moderate, steady speeds many motorcycles are in general too noisy. It is evident that the high performance of such machines has outpaced the art of quieting them. Certain commercial vehicles are somewhat noisy but could probably be improved in many cases by attention to engine and gear noises and, in a less degree, to exhaust noise."

FOSSILS IN NEW MEXICO

THE fossilized skull of a shark which inhabited the fresh water streams of New Mexico in the Paleozoic geologic era of about 225,000,000 years ago, has been found in New Mexico by a party of University of California scientists. Thirteen skulls of amphibians of the same era, and numerous fragments of as yet unclassified reptiles, were also uncovered.

The skull of the shark was about six inches wide and a foot long. This animal was probably four feet in length. It had teeth not more than a quarter inch in length, and large gill arches.

The largest of the amphibian skulls was ten inches in length and eight inches wide. The body of this animal was about four feet long. Its entire bodily structure was thin and delicate. A peculiar feature was the existence of four spines, which projected back over its neck. In appearance it resembled somewhat the giant salamander found in Japan to-day.

These remains were found embedded in the side of a hill near the head of a dry stream bed, the Arroyo de Agua, which is about sixty miles northeast of the City of Santa Fe. S. P. Welles, laboratory assistant in the museum of paleontology, who was in charge of the party, says that this area was undoubtedly a flood plain, with streams and lakes, somewhat similar to that of the lower Mississippi to-day.

The fossils were found deposited in layers or beds. These discoveries are the first of their kind to be made in New Mexico. Beds of these animals have been found in Texas, and it is now hoped to correlate these with the New Mexico deposits. If it is possible to do this, it will facilitate the study of these animals and assist paleontologists to trace their gradual evolution. Mr. Welles was accompanied on the trip by R. E. Moore, D. M. Taylor, B. B. Wilder, J. B. Johnson and Alfred Oakley, all of whom are students in the university.

COLORS USED TO ATTRACT INSECTS

MANY insects have favorite colors, just as human beings do, and these preferences are being used to lure crop pests to their destruction in a device invented by two University of California entomologists, Professor W. B. Herms and J. K. Ellsworth.

The device consists of a lamp surrounded by a cage of electrically charged wires to kill the insects when they make contact. The lamp, instead of shining with ordinary white light, is given the color favored by the particular destructive insect species it is desired to eliminate. Thus, light blue is the color most attractive to grape leafhoppers and artichoke plume moths, both of them costly unwanted guests in California vineyard and truck regions. Light blue therefore is the glow-tube that lures these pests to electrocution on the wires of the Herms-Ellsworth "Monolite."

The Herms-Ellsworth invention has been of especial value to artichoke growers. The whole commercial artichoke crop of the United States is raised in five California

counties, and the plume moth had been destroying 25 per cent. of the heads. Arsenical sprays, effective protection for some crops, could not be used, because there is no way of washing the poisonous residue out of the heads, and regulations of the U. S. Food and Drug Administration forbid the sale of poison-bearing vegetables.

Installation of "Monolites" in the artichoke fields, one to an acre, cost about $30 an acre, and have reduced the losses due to plume moth infestation from the old figure of 25 per cent. to three per cent. Incidentally, the reputation of artichokes as an exclusively aristocratic vegetable is scotched by its sales record. Half the American crop is sold from pushcarts on New York's lower East Side.

AGRICULTURAL PRODUCTS IN INDUSTRY

WHILE potato growers have been making "hot news" of their wishes for smaller crops and larger profits, despite an apparent reluctance on the part of the AAA, chemical industry is looking forward to a time when a controlled agriculture will be "adjusting" its production in the opposite direction, in order to feed factories that will be even hungrier for corn and cotton than pigs and people are.

A glimpse of this coming alliance between industry and agriculture was given at Cornell University in an address by L. F. Livingston, president of the American Society of Agricultural Engineers. Speaking of the AAA program, Mr. Livingston said, "It was a situation without precedent, yet such was the emergency that something of the sort was mandatory to check the economic collapse of one-half the people."

But the emergency phase of crop reduction to prevent ruinously low prices for farm products is already passing, he continued. The tide is setting the other way, thanks largely to the need of industrial plants for raw materials from the land, to be worked up into manufactured goods through the processes of organic chemistry. And new chemical inventions now in the experimental stage will increase this demand many fold, doing all sorts of things, from building roads out of cotton to making "dry ice" out of by-products of the industrial fermentation of corn.

Even now, more than ten per cent. of the corn crop has as its market the factory, Mr. Livingston said, and "uses for corn are being urged that, if adopted, would consume the entire present crop without leaving one ear for one Iowa hog."

Scientific research, the speaker indicated, is the key to the chemical hook-up between industry and the farm of the future. The great industrial firms are bringing their research resources to bear on farm problems, joining forces with the research work of federal and state governments, which have long been in the field. The industrialists are doing this because they realize that the farmer is not only a prime source of raw materials for their plants, but also because it has become inescapably evident that the great farm market is indispensable to a stable industrial prosperity. "We are in the early dawn of a new golden era in agriculture. The first signs of that dawn are already streaking the sky."

ITEMS

MONTANA'S earthquake, which caused considerable damage in Helena and was felt in other cities, apparently was caused by a different fault, or slipping rock-flaw, than the one which started the more severe shock that rocked the state ten years ago, U. S. Coast and Geodetic Survey seismologists stated after examining wire reports transmitted through Science Service. As nearly as they could locate it by preliminary calculations, the epicenter of the present quake is from thirty to fifty miles farther west than that of the earthquake of June 27–28, 1925.

DRY weather has worked both good and ill to the farmers. It has enabled the corn-picking season to get off to a good start in some localities, notably in the Northwest and the northern prairie areas. But it has also intensified the autumn drought that had already handicapped next year's crop severely, by delaying fall plowing and by preventing the sprouting of seed grain already in the ground.

THE second largest auditorium in the country, which will seat 14,000, is nearing completion in Kansas City. The largest is the famous Atlantic City structure. The new building tested the skill of engineers, for it encloses a vast space 225 by 190 feet that is unobstructed by a single vertical column. Two main steel roof trusses 226 feet long solved the problem. The auditorium, costing $4,500,000, is only one notable feature of a building occupying an entire block, *Engineering News-Record* reports. Under the same roof are a 3,000-seat theater and four acres of exhibit space.

THE Royal Danish Serum Institute, at Copenhagen, will become a sort of international clearing house for serums used in treating or preventing disease, as a result of action taken at Geneva by the eleventh Congress of Biological Standardization held in connection with the League of Nations Hygiene Congress. The Danish Institute has been appointed the international center for preparation and standardization of serum for such diseases as dysentery, lockjaw, diphtheria, pneumonia and wound fever. London will similarly become the international center for vitamins, insulin and the sex hormones. International standards for the preparation and composition of twenty-five of the medicaments to be distributed from Copenhagen and London have been agreed on by the Congress of Hygiene.

FOUR-LANE roads are active death traps and at least two states are taking steps against them. Accident frequency records on Indiana's four-lane road that skirts Lake Michigan has caused that state to announce that it will build no more such wide roads without a dividing parkway. At the same time, New Jersey is planning to split eight miles of the Brunswick pike in the middle and slide two lanes of the concrete pavement far enough to one side to provide for a separating parkway. "The cost will be $50,000 per mile for eight miles, and this investment is made purely for safety—no more travel space is added," says the *Engineering News-Record* in reporting the change of thought toward the highway.