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THE LIMITS OF THE UNIVERSE AND THE CURVATURE OF SPACE

PROFESSOR HOWARD P. ROBERTSON, mathematical physicist of Princeton University, in the opening address of the 1939 Sigma Xi lecture series, which was given at Louisiana State University on January 20, stated that astronomy has reached a temporary impasse in its attempts to figure out the curvature of space and the limits of the universe.

On the basis of present observation, relativity theory of the universe has led to a model of space which has so large a curvature that its limits—if you think of it as some huge ball—are much too confined. By Einstein's relativity theory curvature of space is linked with the density of matter within that space. To bring about the curvature indicated by present knowledge matter would have to have more than sixty times the density now observed by telescopes. Moreover, if the universe is thought of as expanding, the most distant nebulae would have to have been close together at some time, about 1,000 million years ago. This vast time is much too short, however, for rocks are known on earth which are probably twice as old as this. And the final dilemma of astronomy is that if the limits of the universe correspond to a sphere with radius of 500 million light years then astronomers are now looking through their present telescopes and seeing nearly to the ends of space.

With the 100-inch Mount Wilson telescope, Dr. Edwin Hubble has detected distant nebulae which are about 500 million light years away. A light year corresponds to about six million million miles. Few people seriously believe that astronomers are now looking to the end of space and believe that the new Mount Palomar 200-inch telescope, when it goes into operation, will open new vistas for astronomy. Yet if space has limits now predicted by theories this would not be so.

HIGH-FLYING AERIAL SURVEY PLANES

HIGH-flying special aerial survey airplanes—cruising at 30,000 feet—will end the day of man's ignorance of the earth on which he lives, Talbert Abrams, president of the Abrams Aerial Survey Corporation, told the meeting of the American Society of Photogrammetry meeting in Washington.

Less than five per cent. of the earth's surface is accurately mapped because of the high cost of ground surveying and the inaccessibility of some regions. By aerial photography, from substratosphere altitudes, it should be possible to get accurate aerial maps for less than $1 a square mile. The economic value of accurate maps, Mr. Abrams contended, would make feasible the cost of developing planes that would fly higher even than the substratosphere planes now under construction for the airlines of America, which are designed for operation at a service ceiling of 20,000 feet.

"Considering the economics of high altitude mapping with a wide-angle lens against the cost of mapping at lower altitudes with multiple lens cameras," according to Mr. Abrams, "the advantage is in favor of high altitude airplanes especially equipped for the job. It is my belief that airplanes for high altitude work can be built at a price approximately equal to the price of multiple lens cameras. This being the case, more work could be done in the air and less work would have to be done in the laboratory in transforming photographs made with a multiple lens camera."

Aerial photography at altitudes of 30,000 or even 40,000 feet would be especially valuable over the mountainous regions of the West, where much of the land has low value and it is far too costly to obtain low-altitude maps showing only small sections of the land in each aerial view. With radio-controlled planes of the future it should also be possible to have robot cameras in planes which would fly over the enemy lines and take aerial photographs, recalling suggestions of the Army. It might even be possible, he added, to have aerial cameras project their views on a ground glass screen, televise this image, transmit it back to a television receiver and photograph the televised image. In this way aerial maps in wartime could quickly be obtained.—ROBERT D. POTTER.

THE STEREOPHONIC RECORDING SYSTEM OF THE BELL TELEPHONE LABORATORIES

A STEREOPHONIC recording system, one of the triumphs of communication engineering, will provide New York fair visitors with an "amateur hour" which, John Mills, director of the Bell Telephone Laboratories publications, promises, will amuse the crowds.

The Voder, the machine that talks like a man and in which speech is created entirely artificially by an operator punching a keyboard, will "lecture" at the exhibits of both New York and San Francisco.

Visitors to the Bell System Exhibit Building at the New York show will come upon a long room at one end of which is a formal garden set about 25 feet deep and extending from sidewall to sidewall. The garden slopes up to a terrace on which are seated six persons carrying on a conversation. The spectator will quickly recognize that five are members of the audience and the sixth is an exhibit employee. All they say will be heard plainly through concealed loudspeakers. After a couple of minutes of friendly visiting, the six people will get up and walk the length of the room to rejoin the audience. As they do so, the set moves slowly sidewise and is replaced by a duplicate set. But, instead of people, the chairs are occupied by mannequins.

As they reach the audience, all that the six have said is repeated. Because of the stereophonic recording, which locates the sound in three dimensions in analogous fashion to stereoscopic pictures which give depth to photographs, the words seem to come from the mannequin seated where the person who originally spoke the words was.

The audience will enjoy it, the Bell exhibitors think, in their summaries of the exhibits in the forthcoming issue of *The Bell Telephone Quarterly*, in which Thomas W. Williams describes the New York show and L. N. Roberts the one at San Francisco.

The two exhibits will include the expected demonstration long distance telephone call, as at previous expositions. But this time the calls will not be limited to a selected group of cities. You can call any 'phone in the country—if you are one of the lucky persons chosen by the chance devices set up to make a selection and if you don't mind having a hundred people hanging on the "party line."

The telephone has made a spectacular subject for expositions from the earliest days. The telephone itself, which seemed unbelievable to the skeptics of 60 years ago, was the sensation of the Centennial Exposition in Philadelphia in 1876, the first of the big time expositions in the United States. And at Chicago was exhibited the speech scrambler designed to make transoceanic radio-telephone conversations unintelligible to any who might wish to eavesdrop.

X-RAY TREATMENTS AND GLAND DISEASE

ENCOURAGING results with x-ray treatments of a painful and usually fatal gland disease and a new theory of the cause of the condition are reported by Dr. Evelyn Anderson, Dr. Webb Haymaker and Michael Joseph, of the Institute of Experimental Biology of the University of California.

The condition is known as Cushing's disease. The patients get very fat around the neck, shoulders, face and trunk, become round-shouldered and are troubled with backache and abdominal pain. High blood pressure, diabetic symptoms and diminution of sexual activity are other characteristics of the disease. The patients live about five years on the average.

Now it is suggested that the primary cause of the disease is overproduction of the cortical hormone by the adrenal glands. These are the small glands that are perched like cocked-hats just above the kidneys and that produce life-saving adrenalin and life-essential cortin. An excess amount of this hormone substance has been found in the blood of suspected patients.

Tumor of the pituitary, the small but important gland in the head, has been considered the cause of the condition since the first cases were reported in 1932 by Dr. Harvey Cushing, of Yale University. Other glands were believed to be secondarily involved. X-raying the adrenal glands in a selected group of patients has given encouraging results in the way of reducing the excess weight, modifying the diabetic condition and decreasing the excess of red blood cells.

ULTRA-VIOLET RADIATION FOOD PRESERVATIVE

LONGER storage of meat and other food without spoiling or changes of color is made possible by use of ultra-violet radiation combined with other more usual food preservation practices, Professor Arthur W. Ewell, of the Worcester Polytechnic Institute, told the American Society of Refrigerating Engineers at a recent meeting.

The germ-killing effect of the radiation, now being set to work for bactericidal purposes in a dozen different fields ranging from sterilizing the air in hospital operating rooms to the packing industry, can be attributed to its power of forming ozone from the oxygen in the air.

Proper "housekeeping" methods are necessary to take full advantage of the ultra-violet installation, however. It isn't a cure-all and does not take the place of ordinary sanitary measures. While it will halt the growth of decay germs introduced into a food storage room in which ultra-violet lamps are placed and will prevent their spread, it will not do so if filthy foods are continually introduced.

No marked alteration of the appearance of the food or of its taste is produced unless the radiation used is so intense as to cause burning or the food is placed too near the lamp.

Foods not directly under the light of the lamps can receive the benefit of the ozone if a gentle air current passing the lamps is directed to them, the Massachusetts food preservation expert declared.

Use of ultra-violet light has several other important advantages. First is that it permits the storage of food in extremely humid atmospheres, which cuts loss of the food's moisture by evaporation markedly. Second, a slight coagulation of meat surfaces, which reduces shrinkage, takes place. Ultra-violet radiation also shows undesirable changes of color, particularly if this treatment is combined with low temperature storage.

The taste and color of very few foods other than meat is affected by excessive radiation. Butter and cream may acquire an "off" taste and the butter may be bleached slightly if it is too near the lamp, and some fruits may undergo color changes, but these ill-effects may be eliminated by placing the foods in question out of the direct radiation.

ITEMS

THE year's first comet, so bright that it can be seen through opera or field glasses, has been discovered low in the northwest sky by Leslie C. Peltier, an amateur astronomer, of Delphos, Ohio. In an interview with Science Service he stated that the new stellar object is of the eighth magnitude of brightness, just too faint to be seen with the naked eye. It is easily visible in the six-inch refracting telescope of Princeton University which Mr. Peltier has been using, on loan, for the last 15 years. Near the constellation of Pegasus, the new comet's location is right ascension 21 hours and 20 minutes and its declination 28 degrees north. Whether the comet has a tail or is in rapid motion was yet undetermined on January 19.

WHAT is believed to be the fluffiest snow on scientific record is reported by Professor C. F. Brooks, of Harvard University. It fell at Milton, Mass., where Harvard's meteorological station, the Blue Hill Observatory, is located. There was only half an inch of it, and it took three hours for it to accumulate, for the flakes fell very slowly—less than two feet per second. Professor Brooks blocked out a square yard of it, as it lay on the hard crust of an earlier snow. He packed it into snowballs and weighed it. He found that the water equivalent was only 1/63; that is, it would have required 63 inches of this snow to make one inch of water. Ordinary snow has a water equivalent averaging 1/10, and the fluffiest snows commonly observed range from 1/20 to 1/30.