

ASTRONOMY

Contents of "Empty Space" Revealed by Colors of Nebulae

Yerkes Studies Indicate That So-Called Void Contains
Particles of All Sizes, Some as Large as Speck of Dust



WHITE, BLACK, YELLOW

peoples from the highest to the most primitive types, are the work of Malvina Hoffman. To seek living models who would represent little known tribes, Miss Hoffman traveled around the world.

The sculptor caught many of her subjects in lifelike poses. A bronze Hawaiian balances lightly on his surfboard. A native of the Australian bush stands poised to hurl his death-dealing spear. A lady of India shows the reserve of her class and culture. And farther on is an "untouchable" old woman of India, in sharp contrast. Some of the human types hunted out and modeled for this anthropological collection are said to be on the verge of extinction.

One monument, entitled "The Unity of Man," expresses the idea of man as a well-defined, fundamentally uniform species which has spread over the earth. It portrays in bronze three human types, white, yellow, and black, each man representing the highest physical development of his race. Each carries his weapons: the white man a sword, the yellow man bow and arrows, the black man a spear and shield. The pillar which the men encircle is topped by a globe.

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"AS EMPTY as interstellar space," is a comparison that needs revision as a result of recent researches made at Yerkes Observatory, Williams Bay, Wis. For the gigantic voids between the stars that shine in the night sky are not truly empty. They are filled with an extremely tenuous cloud of fog, which contains so close to nothing that it would be pronounced perfect as a vacuum by a physicist if it were here on earth.

Astronomers know that there is something in the space that seems to be empty because the light of distant stars is dimmed and reddened in its passage through space. This was shown by Dr. R. J. Trumpler of the Lick Observatory as well as by observations made with the Yerkes 40-inch telescope. Distant stars appear somewhat more ruddy than the ones nearer to us. This suggests to the astronomers that interstellar space has an effect like that of the atmosphere of the earth upon the sun's rays. When the sun is near the horizon its rays look red because they must travel through a thick layer of air.

But do not suppose for a moment that the light that is scattered by the air is lost, for it is not. The light subtracted to make the redness of the sunlight reappears as the blue of the sky. The compensation is so exact that it can be figured out theoretically.

Applying a like reasoning to interstellar space and its particles, Dr. Otto Struve, director of the Yerkes Observatory, considered what effect the space reddening of the starlight should have on the space surrounding the stars. It would cause a faint general illumination of space, a slightly radiant screen of the heavens upon which are projected the more luminous images themselves. Dr. Struve computed just how much this background illumination should be expected to contain. The result surprised him.

The total amount of light produced by space should be greater than that of all the stars combined and the color of

this general illumination should be as blue as the bluest daylight of the sky. That the night sky is actually bright and not dark can be easily proved by any observer situated far from city lights. When the eyes are sufficiently adjusted to the dark, the sky appears faintly luminous between the stars and the outlines of nearby objects, such as trees or houses, can be easily perceived.

In certain regions of space, near luminous stars, the interstellar fog may be illuminated so much that these regions appear even brighter than the rest of the sky. This would especially be true if a local condensation in the interstellar fog happens to be near a bright star. It can then be photographed with a telescope because of its great luminosity and it is seen projected as a bright spot upon the faint general sky illumination.

Such spots are called nebulae. The composition of these nebulae is not fully understood. Some of them scatter the light of the stars and their luminosity is therefore due to reflected or scattered star-light. (Turn to Page 364)

ARCHAEOLOGY

Exposition to Show Monte Alban Jewels

ONE OF Mexico's most treasured archaeological possessions, the famous collection of Indian jewels from the treasure tomb at Monte Alban, will arrive for exhibit at the Century of Progress fair, June 20.

The jewels, property of the Mexican government, will be displayed in a car of the Mexican Presidential train. There are more than 500 pieces of ancient Indian jewelry in the collection.

The tomb was discovered last year by Dr. Alfonso Caso, Mexican government archaeologist, in the mountains of the state of Oaxaca. Splendors of this prehistoric American tomb have been compared with the contents of Tutankhamen's tomb in Egypt.

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became as it were entranced, when I threw the bag from me and kept breathing on furiously with an open mouth and holding my nose with my left hand, having no power to take it away though aware of the ridiculousness of my situation. Though apparently deprived of all voluntary motion, I was sensible of all that passed, and heard every thing that was said; but the most singular sensation I had, I feel it impossible accurately to describe. It was as if all the muscles of the body were put into a violent vibratory motion; I had a very strong inclination to make odd antic motions with my hands and feet. When the first strong sensations went off, I felt as if I were lighter than the atmosphere, and as if I was going to mount to the top of the room. I had a metallic taste left in my mouth, which soon went off.

Before I breathed the air, I felt a good deal fatigued from a very long ride I had had the day before; but after breathing, I lost all sense of fatigue.

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The first physician to write a treatise on occupational diseases was Bernardino Ramazzini, in 1700.

GENERAL SCIENCE

Scientists of Many Countries Gather for Pacific Congress

SCIENTISTS from those countries whose shores are washed by the great Pacific Ocean are meeting these first two weeks of June in the sessions of the Fifth Pacific Science Congress as guests of the Canadian government.

More important than the formal papers which report various aspects of biological and physical research in the east and new world west are the informal chats and meetings which will occur between scientists of different nations and races during the progress of the sessions at Victoria and Vancouver.

The turmoil of the Far East, the conflict in arms and territory between Japan and China, the even more important economic rivalries between commercial groups along nationalistic lines can not be completely ignored in the backs of the minds of the scientists who confer on mutual problems. That is perhaps

too much to expect. But in no other field of human activities can politics and economic conditions be more effectively subdued. Scientists working on similar problems, once they have the opportunity to know each other through correspondence and publications, become true internationalists, citizens of the world in the service of humanity. This tendency will be enhanced by the days of personal acquaintance under the favorable auspices of western Canadian hospitality.

These scientists may well establish avenues of common understanding upon problems and racial differences that will aid the statesmen to keep the peace of the world and preserve friendships between the nations.

Thirty-one countries are sending one or more official delegates. The United States has been honored with an allotment of 25 official delegates, while Canada, the host, has 20. Japan has 15.

Dr. H. M. Tory, president of the Canadian National Research Council, is president of the congress' executive committee. Nearly 600 scientists and representative institutions in countries interested in the study of Pacific problems are presenting papers at the fourteen days of sessions which will end on June 14. Many of the scientists will journey to Chicago for the meetings of the American Association for the Advancement of Science beginning June 19 and to see the Century of Progress exposition.

The long distance record in presentation of a paper before the Congress is to be held by Lord Rutherford of Nelson, England's famous physicist, who addressed the first scientific session at Vancouver June 5, speaking over transoceanic radio and long distance telephone from Cambridge, England.

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If such nebulae consist of very small particles, such as atoms of a gas or extremely fine dust, they should redden the light of the stars and appear blue to the observer. In fact, they should be as much bluer than are their neigh-

boring stars, as the sky is bluer than the yellow light of the sun.

On the other hand, if the nebulae consist of large pieces, such as particles of sand or of small stones or meteorites, they should merely dim the light of the stars without making it redder and their own color should be similar to that of the neighboring stars.

A study of the colors of the nebulae should therefore give a clue as to the size of the particles in the nebulae observed. Recent investigations made by Drs. Struve, C. T. Elvey and P. C. Keenan at Yerkes Observatory, have shown that the nebulae are slightly bluer than the stars in their vicinity. But they are not nearly as blue as would be expected if they were composed throughout of very small particles. The astronomers suppose therefore that the nebulae consist of particles of all sizes, but that the proportion of very minute particles is not sufficient to render the light entirely blue.

How many such particles are there in interstellar space? The total amount of gas between the observer and one of the most distant stars investigated is not more than that contained in a cube of air having half an inch on each side. In order to get an idea of the density of this material, imagine that such a cube of air were drawn out in length over a distance, such that light, which travels at the rate of 186,000 miles per second, would require 10,000 years to cover it. The resulting density would be approximately that of interstellar space. The number of larger particles cannot be determined accurately, but there is probably not more than one dust particle in each 15 cubic inches.

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Beautiful phosphorescent light given off by certain sponges living in shallow waters is really due to small worms that inhabit them, according to a discovery just reported by Prof. Emanuel Trojan, of Prague.

The little light-producing worm is scarcely a quarter of an inch long, but can send branches an inch and a half in all directions. Prof. Trojan writes in the London scientific periodical *Nature* how he coaxed the little animal out of its hiding place by attaching the sponge to the edge of an inclined bowl, allowing the water to drip slowly out of the sponge into the bowl. As the sponge became too dry for comfort, the water-loving worms came out.

PHYSICS

American and Dutch Physicists Reach New Low Temperature

Demagnetizing Substance Cooled by Liquid Helium Brings Workers to Quarter of Degree of Absolute Zero

THE GREATEST cold produced and measured by man has now been pushed to within a quarter of a degree of absolute zero, that unattainable heatless point where all motion of the molecules cease and where a gas would exert no pressure whatever.

Two groups of research workers, one at the University of California and the other in Holland, using novel methods identical in principle, have arrived at the extraordinary low temperatures of 0.25 degrees absolute and "certainly below 0.27 degrees absolute," respectively.

The University of California scientists are Drs. W. F. Giauque and D. P. MacDougall, while the Dutch scientists are Prof. W. J. de Haas and E. C. Wiersma of Leyden and Prof. H. A. Kramers of Utrecht. The Americans did their work earlier and published first, and so they now hold the record.

Dr. Heike Kamerlingh Onnes, the pioneer in low temperature research who worked at Leyden, Holland, used the method of lowering temperature by reducing the vapor pressure of liquid helium. He reached a temperature of 0.82 degrees absolute and the same method was used by his successor Dr. W. H. Keesom of Leyden last year to attain 0.71 degrees.

The new low temperature records have been made by taking advantage of the fact that when a substance is magnetized, it heats up. Using liquid helium, made by cooling, liquefying, and solidifying of air, and then liquefying hydrogen to cool the helium, a substance is cooled as low as possible. Then it is magnetized. It heats up. Liquid helium is used to remove that heat. Then it is demagnetized, taking care to keep it heat-insulated. It becomes colder as a result of the demagnetization. Thus lower temperatures than ever before attained have been reached. Technically the method is referred to as "adiabatic demagnetization of paramagnetic salts."

The Americans used a gadolinium sulphate while the Dutch physicists used

cerium fluoride as the substance to be cooled.

It is difficult to visualize the low temperature which is now the "farthest south" of temperature. The absolute or Kelvin temperature scale, abbreviated K., has its zero at minus 273.1 degrees on the Centigrade scale or at minus 459.6 degrees on the Fahrenheit scale, the system used generally to designate everyday temperatures.

Near absolute zero strange things happen. Electricity flows almost without hindrance. Substances show their true nature and can be easily studied. That is a reason why scientists strive for such low temperatures.

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PSYCHIATRY

Mental Disease Develops From Early Infancy

ONE TYPE of a common mental disease, schizophrenia, develops very insidiously from early infancy on, members of the American Psychiatric Association were told by Dr. Jacob Kasanin of the Rhode Island State Hospital for Mental Disease.

Working with Dr. Karl M. Bowman of Harvard Medical School and the Boston Psychopathic Hospital, Dr. Kasanin has been studying 151 cases of schizophrenia for over two years.

Constitutional schizophrenia is the name they give to this type which develops in infancy. At a very early age, before the mental disease is recognized, the child is considered by his associates to be queer, different or odd. He doesn't mix well with others. The actual mental disease is largely an exaggeration of this peculiar personality, in the opinion of Drs. Kasanin and Bowman.

The peculiar personality increases as the little patient grows older, gradually and insidiously developing into the mental disease. In this type of case, the psychiatrists found no unusual environmental stress or strain nor any physical disease to account for the disorder.

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