

COSMOLOGY

Einstein and de Sitter Return To Euclidean Idea of Cosmos

Receding Nebulae and Heckmann's Suggestion Cause Eminent Scientists to Drop Theory of Curved Space

PROF. ALBERT EINSTEIN, father of relativity, says that space may be and probably is the sort of uncurved, three-dimensional space that Euclid imagined and countless generations of schoolboys have learned. Although Prof. Einstein in a sense scraps the less familiar and more complicated brands of space-time that he has been using, this does not affect the validity of relativity, which has been at the foundation of so much scientific thinking for the past two decades.

Worked Together

Prof. Willem de Sitter, Dutch astronomer, who had built his own shape of universe on Einsteinian foundations, joins with Prof. Einstein in espousing space which is on the average Euclidean. These two eminent astrophysicists conceived the new kind of universe when working together recently at Mt. Wilson Observatory and their joint announcement was made to the world through the medium of the *Proceedings of the National Academy of Sciences* just issued. Prof. Einstein is now en route to his home in Germany while Prof. de Sitter is travelling in South America.

This joint announcement, that is sure to cause a furore in the world of science, means that the universe around us may be not only unbounded but infinite, instead of finite and unbounded as Einstein and his followers have previously believed.

In the Euclidean universe now re-enthroned, light travels in straight lines and goes on and on forever and ever. A ray of light would not traverse the circuit of the universe and come back to where it started as it would in the superseded Einstein and other varieties of space. Curvature of space is on the average banished from the universe.

"We must conclude that at the present time it is possible to represent the facts without assuming a curvature of three-dimensional space," Profs. Einstein and de Sitter say in their report.

Two important developments made

Einstein and de Sitter change their universes. One of these was the piling up of evidence at Mt. Wilson Observatory at Pasadena, Calif., by Dr. Edwin P. Hubble and others that the shift toward the red of spectrum lines in light from far distant nebulae is evidence that the universe is expanding at a terrific rate, as high as 15,000 miles per second and that the farther away the nebula the faster the recession.

The other factor was the demonstration by Dr. Otto Heckmann, privatdozent in astronomy at the University of Goettingen, Germany, that an expanding universe can have matter throughout it and still be Euclidean. When Einstein built his first universe he did not dream of an expanding space. He thought it static and constant in size and found himself forced to make space curved to fit this idea. This gave his famous finite but unbounded universe which, upon Dr. Heckmann's suggestion, he and de Sitter now revise.

Red Shift in Light

Into the equations of Einstein relativity which have stood the test of time, Profs. Einstein and de Sitter, following Heckmann's lead, have inserted both Euclidean space and the recessional velocity of the nebulae indicated by the expanding universe idea and the Mt. Wilson measurements of red shift in light from the nebulae. The scientists were then able to compute the density of matter in the universe and found that it compares favorably with the ideas that are current as to how matter is spread throughout space on the average.

It is almost impossible to imagine how thinly spread on the average is the matter in the universe. One pound of matter spread throughout a sphere sixteen times the diameter of the earth would give this extremely small density of matter. And as the universe is expanding at a super-terrific rate at extreme distances outward, always getting larger as it were, the density of the matter in the universe must be getting less and less.

Profs. Einstein and de Sitter observe, however, that as more astronomical data are gathered it will undoubtedly be possible to determine with more precision the density of matter in the universe. If it should turn out that there is more matter per unit volume of space, then it will be necessary to return to the original Einstein space even with an expanding universe. If the matter is more sparsely distributed, it will be necessary to learn to live in a space of average negative curvature, such as Lobatschewski, the Russian scientist, dreamed of a century ago. In this strange space an infinite number of lines parallel to a given straight line can be drawn through any point. (Please turn page)



NEW WEAPON AGAINST CANCER

Seven hundred thousand volts will be made easily available to the California Institute of Technology scientists by two new giant X-ray transformers made by engineers of the General Electric Company. One of these, shown above, has already been shipped to the coast and the other is nearing completion.

Cancer research will benefit from the building of these new transformers, which will be used in the Kellogg Radiological laboratory to operate the X-ray tube of Prof. C. C. Lauritsen. Rays equal in penetration to those of radium at present used in treatment will be produced with their aid. Electricity from the mains at 220 volts, fed into these two transformers placed end to end, will come out at the other end as a total electric pressure of 2,000,000 volts.

The revision of the geometry of the universe by Profs. Einstein and de Sitter does not appreciably alter the geometry of the galaxy of stars in which we live. Consequently it leaves unaltered the theoretical predications originally made by Einstein which so triumphantly vindicated his theory. These are: The wriggling of the orbit of the planet Mercury, the red-shift of the

spectral lines in the sun and companion of Sirius, and the bending of light rays about the sun which is merely the Euclidean interpretation of a Riemann straight line. A straight line in Riemann curved space is curved when interpreted in Euclidean space. The geometry of an Einstein universe is based on the assumption that light travels in straight lines.

Science News Letter, April 2, 1932

COSMOLOGY

Cannot Know Universe's Shape Without More Observations

By PROF. RICHARD C. TOLMAN
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THE ARTICLE of Einstein and de Sitter in the Proceedings of the National Academy shows, if we assume a uniform distribution of material in the universe and assume the cosmological constant to be zero, that our present knowledge as to the density and velocity of recession of matter can be accounted for, if we ascribe the value zero to the spatial curvature of the universe. Our present observational data are thus shown to be insufficient to distinguish

between the three theoretically possible cases of positive, negative or zero curvature, and hence we cannot now say whether the universe is closed, hyperbolic or flat. It is possible that sufficient data to throw more light on such questions will be available in the not too distant future.

The article deals, of course, with the spatial curvature of the universe as a whole when looked at from a large scale point of view and does not affect our views as to the curvature of space in the neighborhood of individual gravitating bodies.

Science News Letter, April 2, 1932

CHEMISTRY

Research Pointing Way to Sugared Mortar in Walls

HOUSES built of candy, the creations of fancy in fairy tales, are making a strong bid to enter the realm of reality. At least, it may not be long before real, liveable houses are built with hundreds of pounds of sugar in their walls, for such houses will have stronger walls than those without sugar, scientists at the meeting of the American Chemical Society have revealed.

The facts about the "structural" strength of sugar were found in investigations to discover more industrial uses for the cane product, which were conducted at the Mellon Institute in Pittsburgh by Dr. Gerald J. Cox and Dr. John Metschl. They have concluded that the use of sugar in lime-sand mortar offers one of the most promising new ways of consuming large quantities of sugar.

The addition of as little sugar as six

per cent. of the weight of quick-lime used will increase the tensile strength of the mortar 60 per cent., their studies show. Further seasoning produces slight increases in strength.

"Lime-sand mortar," the researchers explained, "possesses certain qualities of workability that are superior to cement mixtures or gypsum plasters, but it is lacking in strength. Lime mortar can regain many of its former uses if its strength can be increased.

"We have begun a series of experiments to test the effects of additions of small amounts of sucrose to lime-sand mixtures. Our plan includes tests of tensile strength, compression strength, time of setting, and durability on exposure to a variety of conditions, especially the action of water."

Science News Letter, April 2, 1932



SAUCY

—the new Venus just discovered by archaeologists of the University of Pennsylvania Museum digging at Minturno, Italy.

ARCHAEOLOGY

Broken Nose Gives Piquant Look to Dignified Venus

A VENUS with a broken nose and still beautiful, is the latest prize American archaeologists have unearthed at Minturno, Italy.

The goddess' classic nose was found slightly damaged at the end, but this accident, which would be fatal to beauty ordinarily, has merely wrought a subtle change in the goddess' personality type. Most statues of the Goddess of Love portray a lady of superior calm and poise. This Venus with her tip-tilted nose has a piquant look, and perhaps a sense of humor.

The new Venus is pronounced a Roman copy of Greek sculpture. It is one of a number of unusual art objects discovered by archaeologists representing the Museum of the University of Pennsylvania who are excavating at the ruins of Minturno. Dr. Jotham Johnson is directing the work.

Another new discovery is the base of a statue which is linked with Roman politics of the third century A. D. An inscription on the statue base says that the monument was erected by the citizens of Minturno in honor of Furia Sabinia Tranquillina, "august and most revered wife of Gordianus Pius."

Gordianus Pius was once Emperor of the tottering Roman Empire.

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