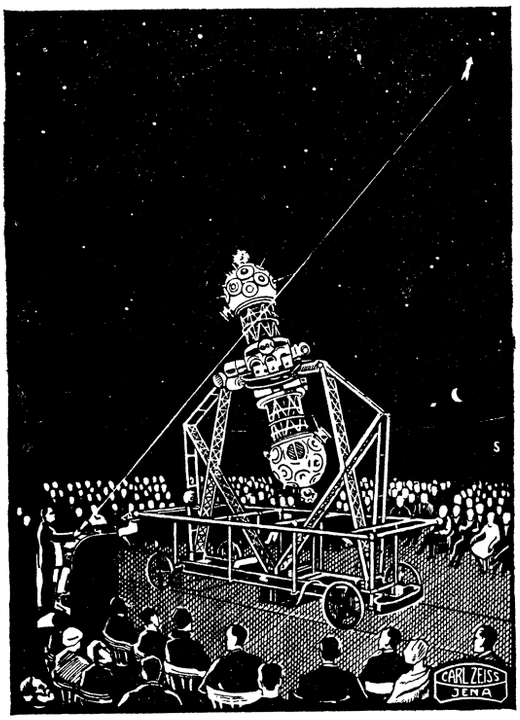

The Interior of a Planetarium

Have Astronomers Been Deceived by Distance To Far-Away Stars?

Astronomy

MUST our celestial distances of hundreds of thousands of light years shrink to tens of thousands? Dr. van de Kamp's studies at the Leander McCormick Observatory of the University of Virginia indicate that this may happen. Star light is absorbed by space, it is being found, and it is likely that this absorption was not sufficiently taken into account in the present calculations.

ASTRONOMERS attending the recent meeting of the American Astronomical Society in Chicago saw a whole year pass in seven seconds.

They were holding a session in the Adler Planetarium and Astronomical Museum, which has been opened on a small island just off the shore in Lake Michigan. Above was the planetarium dome on which images accurately and realistically reproducing the skies were being projected. But the familiar motions of the sun, moon and planets among the stars were being shown far more rapidly than they are ever observed in nature. In seven seconds they saw the planets go through their normal motions of a year. Even the "great year" of 26,000 ordinary ones, during which the Southern Cross and other southern constellations become visible from northern countries, was reproduced in a few minutes.

The planetarium instrument, that makes this possible, is a German invention that projects on a white dome 80 feet in diameter all the celestial objects visible to the naked eye and reproduces their motions. The one in the Adler Museum is the first to be erected in the United States, and this was the first time most of the American astronomers had seen it in operation.

OUR galactic system of stars, which includes all that we can see, may be considerably smaller than was previously supposed. Some of the most distant objects in this system, may be distant tens of thousands of light years, instead of hundreds of thousands. Even the former figure means distances of hundreds of quadrillions of miles, inconceivably great.

Dr. Piet van de Kamp, astronomer of Dutch birth now at the Leander McCormick Observatory of the University of Virginia, told of his researches on the absorption of light in space. It used to be assumed that all that was in the sky was what could be seen or photographed, with either small or large telescopes. Once a ray of light left a star, and started in our direction, it was supposed that it travelled right on without interference, as there was nothing between to stop it.

This assumption was called into question, however, because luminosity, and hence, visibility, is not a necessary attribute of celestial matter. Meteors are continually bombarding the earth, and they are dark and invisible until they are heated to incandescence by the friction with the earth's atmosphere. Huge dark areas have been observed in many parts of the sky, and are almost certainly due to dark masses blotting out the bright material beyond. In addition, space may be full of fine cosmic dust that would absorb light something like a cloud of smoke.

The light of a series of objects at different distances varies according to the famous inverse square law, that is, the brightness is inversely proportional to the square of the distances. Therefore a light which appears to be of a brightness of one candlepower at four meters would appear only one quarter as bright at a distance of eight meters, and not one half as bright. The light would vary in the proportion of 16 to 64 and not of 4 to 8. But if you observed the two lights at different distances in a corridor filled with smoke, the farther one would be fainter than you would expect from the inverse square law, because the longer path over which the light travelled would cause more of it to be absorbed.

If you knew two lights at different distances to be of the same actual brightness, you could estimate their relative distance by estimating how much fainter the more distant one is. But if there is smoke between, then the distant light will seem fainter than it should, and so you will over-estimate its distance.

This principle is used by astronomers to measure the distance of far away stars. Nearer ones can be measured by the displacement they seem to undergo as they are observed

from opposite sides of the earth's orbit, 186,000,000 miles apart. But there are various ways of determining the actual brightness, or candle-power, of a star, such as a measurement of the intensity of certain of the dark lines in its spectrum. Such measures have been used as the basis for distance determinations of very distant stars. Direct photographs have shown how bright they appear, the spectrum shows how bright they really are and the difference has been interpreted as being due to the distance. But if there is absorbing matter in space, then the star would appear fainter than it ought, while the absolute brightness would be the same, and the distance so determined would be too large.

Evidence of Absorption in Space

In recent work at the Lick Observatory of the University of California, Dr. R. J. Trumpler has found good evidence that there actually is some absorption in inter-stellar space. He has studied some of the open star clusters and, by assuming that clusters of the same constitution have approximately the same linear dimensions, he concludes that within our Milky Way system light is absorbed at the rate of .67 of a magnitude in 1000 parsecs. The parsec is the astronomer's measuring stick, and is equal to 206,265 times the distance from the earth to the sun, or 19,200,000,000,000 miles. Another way of expressing the absorption calculated by Dr. Trumpler would be to say that 39 per cent. of the light is absorbed every time it travels a thousand parsecs.

This rate of absorption refers to the light that affects a photographic plate, the shorter waves of the blue and ultraviolet. The longer waves of yellow light that we mostly see by are only absorbed about half as much. But measures of star magnitudes, used in determining distances, are mainly by photography, so the higher figure is the one to be considered. He also found that the absorption takes place mainly in the region of the Milky Way. Our system of stars is approximately the shape of a grindstone and we are somewhere near the center. When we look towards the edge of the grindstone we look through a much greater depth of stars than when we look to the sides. This concentration of stars to the edge causes the appearance of the Milky Way. The fact that the absorption takes place mainly in this region suggests that the absorbing stuff is distributed in the form of a thin sheet through the middle of the grindstone.

Blue Light Rapidly Lost

Dr. van de Kamp, who has been working on the same problem independently, confirms Dr. Trumpler's results. He has studied a number of stars of spectral types B and A, which are bluish in color. But he finds that the farther away they are, the less bluish they appear. As there is no reason to suppose that the color of their light actually varies, depending on how far they are away from us, he concludes that their light is absorbed in its passage, and that the blue light is absorbed more rapidly than the red, or longer waves. He believes also that the absorbing stuff is concentrated in a thin sheet in the plane of the Milky Way, and agrees with Dr. Trumpler that it is probably about 175 parsecs in thickness.

Dr. Harlow Shapley, director of the Harvard College Observatory, in a study made a few years ago of nebulae which are completely outside our galactic system, came to the conclusion that their light was not absorbed appreciably. Evidently space outside our system is quite transparent. As none of these nebulae are observed in the direction of the Milky Way, the absorption of their light after it reaches our system would be negligible. Hence the vast distances determined for those objects, tens of millions of parsecs, are still apparently valid. But the distance of stars in our own system, and in the direction of the Milky Way may have to be modified considerably. Dr. van de Kamp estimates that stars really only 5,000 or 10,000 parsecs away, for example, would seem to be at 23,000 and 220,000 parsecs respectively, when no allowance is made for absorption.

Dust, Meteors, Electrons . . . ?

In his report to the Astronomical Society, Dr. van de Kamp did not make any suggestions as to the nature of the absorbing stuff. Dr. Trumpler, however, recently suggested that in addition to fine cosmic dust and large meteors, it might consist of free electrons, or pieces of atoms that have become ionized and had some of their electrons removed, and free atoms, of calcium, sodium and other elements. There is other evidence for highly rarefied clouds of calcium floating around between the stars.

Science News-Letter, September 6, 1930

Fighting Leprosy With Vitamins

Medicine

HOPE that one of the world's oldest and most loathsome scourges may be conquered is contained in reports from Japan that Dr. K. Shiga, bacteriologist and dean of the Imperial Medical Faculty at Seoul, Korea, has discovered that vitamins in sufficient amounts will prevent infection of animals, and presumably men, with leprosy.

Although the leprosy bacillus was discovered in leprous sores of persons afflicted with the disease more than 50 years ago, it has hitherto not been possible to transmit leprosy to lower animals by inoculation. A solitary case of experimental transfer of the disease from man to man, from a leper to a condemned criminal in the Sandwich Islands, was not regarded as convincing evidence, because the convict had other opportunities of contracting the disease. After many futile attempts to reproduce leprosy experimentally, scientists were forced to assume that a special individual susceptibility to the disease is requisite for its production.

This old assumption of the necessity of individual susceptibility to leprosy is now verified by Doctor Shiga. When he injected leprosy bacilli taken from human leprous sores into normal, healthy rats, the animals remained normal and showed no signs of the disease. They were not "susceptible" to leprosy. Later, however, after the food of the animals had been deprived of vitamins, they soon developed leprous sores and became victims of the disease. They had become "susceptible."

If such a simple dietary deficiency accounts for animal or human susceptibility to leprosy, then it will be possible to protect people from leprosy by merely watching their bill of fare and perhaps even to cure lepers by adding vitamins to their food.

Science News-Letter, September 6, 1930

All the states except two now have laws permitting municipalities to control the use, height, and area of buildings by district or zones.

The busy honeybee sometimes flies eight miles to gather honey, and then flies eight miles back to the hive.