

motorcycles, and even bicycles and hand-carts approach the intersection, the steel in them changes the magnetic field.

This magnetic change trips off the relay mechanism which turns the traffic light at the corner from red to green. This green signal lasts from 10 to 15 seconds and then gives the right of way back again to the main highway.

Should a vehicle from the side street be immediately followed by another, the latter is not given the green light before a minimum time for the green light in the main street has expired. In this way the traffic on the main highway can be prevented from being blocked by a stream of vehicles from the side street.

The only kind of vehicle which will not actuate the magnetic signal system is one which contains no iron, steel or other magnetic material.

An additional use of the Ericsson system, as it is known, is for an automatic traffic counter. The registering apparatus drives a reel of paper upon which it draws columns proportionate to the size of the traffic flow for a given time interval.

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GEOLOGY

Siberia's Frozen Ground Is Survival of Ice Age

THE ICE AGE is not a thing of the past. It survives underground, in the permanently frozen soil of Siberia and other high-latitude lands, where summer thaws out the soil to a depth of a few inches or a few feet, permitting plants to grow, while beneath, to an unknown depth, are earth and rock that have been ice-bound for a million years.

How this survival of the Pleistocene makes trouble for present-day engineers and other practical people was told at the meeting in New York of the Geological Society of America by Prof. George B. Cressey of Syracuse University.

All heavy construction in this area, undertaken by the Soviets, has to be built on piling. To soften the earth enough to permit the piles to be driven, steam jets have to be used. At one place, Igarha, a lumber mill engine stands on wooden "roots" that go down nearly 70 feet to bedrock.

Water mains give particular trouble. If the engineers cannot find unfrozen ground of sufficient depth, they have to lay the pipes in board-lined trenches, and along with the water mains they must install steam pipes to keep the water from freezing, with the whole filled in with sawdust or moss.

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ASTRONOMY

Limits of Universe Still Beyond Astronomers' Reach

Calculated Curvature of Space Much Too Confined For Known Density of Matter, Scientist Declares

ASTRONOMY has reached a temporary impasse in its attempts to figure out the curvature of space and the limits of the universe, said Prof. Howard P. Robertson, mathematical physicist of Princeton University, in the opening address of the 1939 Sigma Xi lecture series at Louisiana State University.

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 a huge ball—are much too confined, Prof. Robertson said.

Not Enough Matter

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 60 times the density now observed by telescopes.

Moreover, continued Prof. Robertson, if the universe is thought of as expanding, the most distant nebulae would have had to be 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 present telescopes and seeing nearly to the ends of space.

With the 100-inch Mt. Wilson telescope, Prof. Robertson pointed out, Dr. Edwin Hubble has detected distant nebulae which are about 500 million light years away.

Few people seriously believe that astronomers are now looking to the end of space and believe that the new Mt. Palomar 200-inch telescope, when it goes into operation, will open new vistas for astronomy. Yet if space has limits now predicated this would not be so.

"We seem to have come to an impasse with this line of attack; I find myself unable to accept the model to which such so large a curvature almost inevitably leads, and unwilling to postulate *ad*

hoc some new principle to lift myself over the difficulty," said Prof. Robertson. "Looking back over the assumptions involved in the determination of the present value of the curvature, we find that at many points the conclusion is sensitive to even relatively slight uncertainties; above all, the method is highly sensitive to lack of uniformity in the distribution of the nebulae, whether this be due to fluctuations in the statistical material or to large-scale structural features of the nebular system.

"That density gradients, of such a magnitude as to raise considerable doubt concerning the validity of the method, do in fact exist in regions closer to us than those emphasized in Hubble's surveys, is clearly shown by the recent survey of Shapley of some 75,000 nebulae brighter than the 18th magnitude in southern galactic latitudes.

Uneven Distribution

"On arbitrarily dividing all his material into the eastern and western hemispheres, Shapley finds that the number of nebulae per square degree in the former exceeds that in the latter by between 40 and 50 per cent; similarly he finds that the number of nebulae per square degree in the central portion of the plates taken from the southeast quadrant is more than twice the corresponding number for the northwest quadrant even although he is here dealing with a total of almost 20,000 nebulae.

"The existence of similar density gradients along the line of sight at the distances involved in Hubble's surveys might easily mask or distort the curvature effect which we are seeking; until more positive evidence on this point is available, it would therefore seem expedient to seek our additional datum elsewhere—perhaps most hopefully in an accurate determination of the deviations from the linear velocity-distance law at greater distances, for this effect should be much less sensitive to departures from the distribution implied by our homogeneous models."

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