

answer to the question of whether red-shifts actually are velocity-shifts. A possibility exists that the light from far-off objects may have lost energy during its long, lonely journey through space, causing its wavelength to increase. In this case, some principle of nature as yet unknown would account for the red-shifts.

However, whether or not they represent speeds of recession, Dr. Humason said, the red-shifts promise to give astronomers a convenient yardstick to establish the distances of new-found objects in space. Once the red-shift is measured, the distance will automatically be known. This will be possible when the range of the law, now regarded as a first approximation, is pushed still farther into a cosmos and after uncertainties in distances assigned to outlying nebulae are removed.

The latter is the province of Drs. Edwin P. Hubble, Walter Baade and their colleagues. They report that construction of a thoroughly reliable scale of cosmic distance is now under way, using all the resources on Mt. Wilson and Palomar.

The over-all program involves not only photography but also extremely sensitive photoelectric cells developed during World War II. They are being used to measure the brightness of stars and nebulae several

million times fainter than the faintest stars the human eyes can see.

Step by step, as outlined by Dr. Hubble, the distance scale will be set up as follows:

Globular clusters, or compact masses of thousands of stars, relatively near the earth, will be used to establish the distance of the great spiral nebula, Messier 31. This will fix the brightness of its Cepheids, or regularly varying giant stars, and its novae, or exploding stars.

Cepheids and novae then will be used to measure the distance of other nebulae as far out as the Ursa Major Cloud and the first cluster found in Virgo. These are roughly six and eight million light years away.

This done, the astronomers will have a collection of about a thousand nebulae of all types. The nebulae themselves can then be calibrated as distance indicators. Their average brightness, variations from the average and the brightest nebulae in clusters will provide a yardstick to measure the distance of more remote clusters.

"When the new scale is available," Dr. Hubble says, "the law of the red-shifts can be formulated precisely. It can then be discussed with confidence as a clue to the nature of the universe."

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silver iodide or dry ice than that man can actually make it rain, Dr. Barnes pointed out to the subcommittee.

If actually making rain should prove possible, this would also be of great value in helping to control forest fires. Some cloud seeders have made claims that they have put out fires, but these assertions can not be verified.

When forest fires are burning, even an increase in the air's humidity helps to slow down the fire's spread, making it easier to control by conventional methods.

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### METEOROLOGY

# Break Up Clouds, Halt Fires

► BREAKING UP clouds to prevent dry lightning that causes disastrous forest fires was urged by Dr. Carleton P. Barnes, research coordinator in the Department of Agriculture's Agricultural Research Administration. The clouds would be seeded with silver iodide or dry ice.

More research on actually trying to make it rain by similar methods is also needed, he told a House Interior subcommittee holding hearings on a bill to authorize the Interior Department to spend \$25,000,000 for research on rain-making and on "sweetening" salt water.

Lightning is the cause of many disastrous forest fires each year. By dissipating the towering cumulus clouds that are often the source of dry lightning storms in the Northwest and Southwest, Agriculture's Forest Service officials believe they could cut down considerably on the devastation from lightning-caused forest fires.

Breaking up clouds also has military applications. It might help to clear a target area for bombing runs or to clear an airport closed in by bad weather.

Evidence is much stronger that clouds can be broken up by seeding them with

## Question Box

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Photographs: Cover, Pat Kirkpatrick; p. 403, Mt. Wilson-Palomar Observatories; p. 405, Atomic Energy Commission.

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