

# 3000° "Sleet" Storm For Mirror

*Astronomy*

"Sleet storms" at 3,000 degrees Fahrenheit, in which a layer of clear transparent quartz is coated on a base of white quartz by an oxy-hydrogen blowpipe, much the same as a clear layer of ice is sometimes coated on trees in a rainstorm in cold weather, may make possible the new 200-inch telescope, planned for the California Institute of Technology.

Speaking before the American Philosophical Society at Philadelphia, Dr. Elihu Thomson, director of the General Electric Company's research laboratory at Lynn, Mass., told of his researches on methods of making the huge mirror. This mirror, 200 inches or sixteen and two-thirds feet in diameter, will be the heart of the telescope. It will be twice the diameter of the largest telescope mirror ever made before.

Unlike the ordinary small telescope, the new instrument will be a reflector, in which a dish-shaped mirror concentrates the rays of light from a distant star into a point on the photographic plate or in the eyepiece through which the astronomer looks. The final curve of the mirror must be ground very carefully, so that it will have exactly the right shape, and give a sharp image.

Glass is the most popular material for telescope mirrors at present, but it has some disadvantages, pointed out Dr. Thomson. Changes in temperature produce a considerable change in the size of the glass. When any grinding is done, the friction heats the mirror. Then it must be allowed to cool before it can be tested, all of which consumes much time. And then, when the figure has been completed, and the telescope is in use, slight changes of temperature produce considerable changes in the image seen in the instrument.

Therefore, said Dr. Thompson, "it is not glass that we shall use, but fused silica, or melted quartz, melted in an electric furnace at between 1,700 degrees and 1,800 degrees Centigrade, which means more than 3,000 degrees Fahrenheit, or about the melting point of platinum, a metal difficult to melt, as is well known, and which does not melt in ordinary flames or furnaces. The method we shall use, and which we are using, in fact, on a small scale with great success, is, in general terms, one devised quite a number of years ago, and which consists in first melting a mass of good clean quartz sand in a circular mould

in an electric furnace, and obtaining thereby a disc or thick slab of melted quartz sand. This is, indeed, fused quartz, but full of tiny bubbles, which tend to make it lighter, but the melted sand has all the desirable properties of the solid fused quartz itself."

Quartz has the advantage that it retains practically constant size for all ordinary temperatures. This makes a quartz mirror easier to figure, and to use after completion. But the rough quartz disc, full of bubbles, will not take the smooth silver coating that reflects the light rays to a focus.

"This comparatively rough bubble-filled mass of melted sand, which is the underlying disc, has to be provided with a surface layer, more or less thick, of clear glass-like fused quartz, or silica glass," continued Dr. Thomson. "It will have the same general properties, so far as expansion goes, and, therefore, will suit the purpose very well united to the sand backing. The first efforts were made by melting on to the fused sand backing slabs of clear quartz made in a different way, and the results were fairly successful. Fair mirrors could be made in that way, but at the suggestion of one of our skilled workers, an experiment was made of feeding into an oxy-hydrogen blowpipe flame, granulated or finely

powdered crystal quartz (rock crystal) of high quality, and immediately it was found that a coating of clear quartz could thus be deposited upon any other piece of quartz. When oxygen and hydrogen are burned in a jet, the temperature of the flame is high enough to fuse or melt silica, or quartz. By raining down through such a flame, the granulated crystal quartz is received on a surface much as ice deposits in clear layers on objects during a sleet storm. In illustration, I often use the analogy, only adding that ours is a high temperature sleet storm, with quartz deposited in clear layers instead of ice.

"Extending this to a mirror, it was found that under proper precautions of temperature, the surface might be glazed with clear fused silica to any ordinary desired thickness, by the simple process of introducing high grade silica into a flame of such temperature as will melt readily the particles of silica as they pass through it towards the surface which receives it. In this case, of course, it is the surface of the mirror to be, as composed of the fused sand backing, which in the way I have outlined is covered with a layer of beautiful, clear, transparent fused quartz."

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## Earth To Grow Rings

*Astronomy*

The rings of Saturn, now unique in the heavens, as far as astronomers know, may be rivalled by a similar system around the earth in the dimly remote future, Dr. Harlow Shapley, director of the Harvard College Observatory, believes.

"For some years we have been familiar with the fact that the earth's rotation is slowing down, that the day is lengthening, and that the moon is receding," said Dr. Shapley in a lecture at the College of the City of New York. "We have learned that after an interval of some fifty thousand million years the month and the day will be the same length again, as they were at the time the earth-moon system was formed. This equality of month and day in the future will be forty-seven of our days in length; at the time of the origin of the moon from the earth it was less than five of our present hours in length.

"According to calculation, the moon will ultimately return to the earth, and in the dimly remote future its fate will be disruption by the tidal forces of the earth and transformation into a ring system of myriads of moons such as that now observed around Saturn. This process may fail of completion if in the meanwhile the sun's stores of energy have become exhausted and our oceans have become frozen, stilling the tides which are involved in the machinery of the evolution of days and months. The irregularities are probably due to pulsations of unknown origin in the earth's crust."

Though so close to us, compared with the stars, and though such a vast number of observations have been made of them, the planets and moons associated with the earth in the sun's family present some of the most baffling astronomical mysteries, Dr. Shapley said.

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