1032

CARNEGIE INSTITUTION OF WASHINGTON
MOUNT WILSON OBSERVATORY
PASADENA, CALIFORNIA

H. J. T. AUG 27 '928 HJT A

August 24, 1928

Mr. H. J. Thorkelson
International Education Board
61 Broadway, New York City.

My dear Mr. Thorkelson:

Thank you for your telegram. I have also seen your letter of August 1 to Dr. Millikan, and am sending a brief report regarding the situation, which will be followed as soon as possible by our estimates for six months.

Mirror Disk. The Observatory Council has held several meetings, and has had the aid of Dr. Anderson and the Advisory Committee, enlarged to include Messrs. Adams, Seares, Abbot, Michelson, Russell, Tolman, Epstein, and Bowen. All of these gentlemen are here except Russell and Epstein, and we have had long letters from the former. We have also had advice from Dr. Frederick E. Wright of the Geophysical Laboratory and Dr. Frank E. Ross of the Yerkes Observatory, both of whom are here, and from Dr. W. W. Campbell and Professor Edwin B. Frost, as well as from various members of the staffs of the California Institute and the Mount Wilson Observatory. As there has been unanimous agreement regarding the general design of the telescope and the desirability of using mirror disks of solid fused quartz (not a single person favoring Ritchey's cellular construction), we have requested Dr. Elihu Thomson to proceed at once with his experiments in making and coating a 22-inch quartz disk, to be followed by a larger size (suitable

for use as one of the minor mirrors of the telescope) as soon as possible. Mr. Gerard Swope, President of the General Electric Company, has telegraphed

"General Electric Company will be delighted to do the work on the fused quartz lens under the personal direction of Professor Thomson who is much interested in it at manufacturing cost without any overhead for commercial or administrative expenses",

and both Mr. Swope and Professor Thomson have written us very cordially and enthusiastically to the same effect. We feel very confident that a suitable quartz disk can be made. If there should prove to be insuperable difficulties because of the thickness necessary for a 200-inch mirror, we can almost certainly build it up out of several thinner disks cemented together.

Optical Design of 200-inch Telescope. The underlying principles involved in the design have been extensively studied, especially by Messrs. Anderson, Pease, Seares, and Ross, the last of whom has come out from the Yerkes Observatory for this purpose. It has been decided to adopt the ratio F:3.3, which will mean a tremendous concentration of light and the possibility of photographing extremely faint stars, especially those constituting the spiral nebulae, almost all of which are beyond the reach of the 100-inch telescope. Such a ratio means a comparatively small field of good definition in the principal focus, but Dr. Anderson and Dr. Ross think it probable that Dr. Ross (the best man in the country for such work) can devise a special lens to go in front of the plate and increase the size of the sharp field when this is desirable. (For the faintest stars no lens will be used). Dr. Ross is so much interested in

this problem, and in several other optical devices which may add enormously to the efficiency of the 200-inch telescope, that he is willing to devote most of his time to this work during the next year. We therefore propose that he be employed for this purpose, as Professor Frost has cordially expressed his approval.

Site. We have been fortunate in having the advice of Dr. Charles G. Abbot and of others who have studied the availability of sites in California and Arizona for astronomical purposes. Dr. Charles F. Marvin, Chief of the Weather Bureau, has supplied many meteorological data and agreed to loan us several sets of recording instruments. We have selected and looked at three sites for immediate examination, and systematic astronomical observations are under way at two of them. These are Palomar, about 35 miles inland from Oceanside; Horse Flats, about 15 miles north of Mount Wilson; and Table Mountain, about 25 miles from San Bernardino, where Dr. Abbot has had a station in operation since 1925 for the measurement of the solar radiation. Two or three other points will be examined later. Dr. Anderson has devised a new method of measuring (instead of estimating) the quality of the definition, under a power of 600 diameters, and Mr. Ellerman is now using this method at Palomar. Mr. Robinson, Dr. Anderson and I visited this very remarkable site last Saturday, and were as much impressed with its natural advantages and the extreme purity of the sky as Dr. Adams, Dr. Pease, and other members of our staff have been. All of the observations so far made seem to indicate that it is distinctly better than Mount Wilson for

sharpness of definition, and very greatly superior for purity of the sky. The absence of smoke from any large city and of lights in the valley below are factors of importance. However, a long series of comparative tests, both astronomical and meteorological, will be needed to settle the site question.

Design of Telescope Mounting. Although working drawings should not be made until later, the general design of the mounting must be studied from all angles from the outset. The determination of the ratio of focal length to aperture (F:3.3) and our decision to use a 40-foot Michelson stellar interferometer attached to the upper end of the tube, have defined two of the most important features in the design. In the study of the interferometer problem we have had the benefit of our experience at Mount Wilson, of Dr. Michelson's presence here this summer, and of the advice of Dr. Aitken of the Lick Observatory, a prime authority on double stars. He is convinced that if we can build a 40-foot interferometer which can be rotated in position angle, it will be possible to measure more than a hundred spectroscopic binaries with extreme precision. This would give us for the first time accurate values of the masses and densities of the separate components of many double stars in various stages of development, and contribute in high degree to the solution of the problem of stellar evolution, as well as to many other problems bearon the constitution of matter. (The 50-foot interferometer under construction on Mount Wilson is not suitable for such work, as it cannot be rotated in position angle).

Several other general questions affecting the de-

sign of the mounting have also been settled, but much time must be given to the details, and later to the working drawings.

Photographic Processes. We have taken up with Mr. George Eastman and with Dr. Mees, Director of his Research Laboratory, some fundamental photographic questions. They are keenly interested, and will be delighted to study these problems for us. Some recent discoveries, which indicate that the speed of plates can be increased without decrease in the size of the grain, lead Dr. Mees to believe that an important advance can be made. No other means of increasing the space-penetrating power of the 200-inch telescope is so promising as this. Various other photographic questions, including improved means of sensitizing plates for various parts of the spectrum, should also be investigated.

Auxiliary Instruments. The general study of instruments and devices for receiving, recording, and interpreting celestial images, undertaken in a broad way for the first time in accordance with our plan, is of the greatest importance. The receiving end of a telescope is at least as vital as the light-collecting end, and the only way to make really effective use of a 200-inch mirror is to provide the best possible means of utilizing the light it concentrates.

Our original scheme called for a large machine shop, at least twice the size of the Mount Wilson shop. We have decided, however, to fix the size of the shop chiefly by the requirements of the auxiliary apparatus, which means that tools large enough

to build the 40-foot interferometer and other large auxiliaries will serve our needs. Most of the telescope mounting, which will demand much larger machine tools, can be built by Warner & Swasey, or elsewhere.

As the Mount Wilson shop is used to its full capacity to keep up with the needs of the present Observatory, our first necessity will be a similar shop on the campus of the California Institute. This cannot be in our proposed Astrophysical Laboratory, because of vibration from the planers and other machinery. We therefore wish to put up a one-story building for this purpose as soon as possible, and will include this in the estimates now in preparation. The development of the Mount Wilson Observatory has been chiefly dependent upon the facilities for experiment afforded by its shops, and in the present case our need for such facilities is even greater, because of our general attack upon the problem of highly efficient auxiliary instruments.

The estimates will follow as soon as possible. It will be advantageous to us to know the date of the meeting when fixed, and the action when taken. We have succeeded thus far in keeping the scheme out of the newspapers, but some rumors have reached them in spite of us, and they are keeping quiet through courtesy and in anticipation of definite information, which we have agreed to give them if and when your Executive Committee takes favorable action.

With kind regards,

Yours very sincerely,

George E. Hale