

an early date. In Japan the altitude would be lower again and the duration of totality less.

It was agreed to ask Dr Minnaert, Capt. Hellweg, Prof. S. Hirayama and Mr Eropkin, secretary of the Solar Commission of the Leningrad Academy of Science, to act as advisers to be consulted by would-be observers and to arrange co-operation.

Outstanding eclipse programmes were then discussed and the following suggestions were made for observers' programmes:

(a) Accurate wave-length determination with high dispersion spectrographs, at the cusps for different levels in the solar atmosphere, with a study of changes at different levels.

(b) More accurate coronal wave-lengths.

(c) Work in the extreme infra-red and ultra-violet both for the corona and the chromosphere.

(d) Coronal photography.

(e) Photometry of corona.

(f) Polarization of inner and outer corona and a study of the law governing the variation with distance from the limb.

(g) Distribution of coronal motions by an objective interferometer.

(h) Widths of chromospheric lines, in profile, especially at high levels.

(i) Changes of colour of skylight at eclipse.

(j) Contours and displacements of absorption lines in the outer corona.

(k) Duration of Baily's beads.

(l) Photometry of the vanishing crescent.

(m) Photography of Mercury at eclipse, when placed at a high altitude.

Mr Robertson offered to arrange for the computation of the tracks of further eclipses and mentioned that the track of the 1937 eclipse—a seven-minute eclipse—nowhere touched land. An island, which had once lain in the track, had sunk below the ocean. He was asked to compute the track of the 1940 eclipse so that meteorological observations might be made along the track.

Commission 14. (WAVE-LENGTHS.)

ACTING PRESIDENT: Mr H. D. Babcock.

SECRETARY: Mr W. F. Meggers.

A provisional list of recommendations based upon the Draft Report prepared by Prof. Fowler served as a guide for discussion and action by the committee. The recommendations, together with a digest of the discussion and the action taken, are reported below as a record of the proceedings of Commission 14.

1. It is recommended that two or more observers should investigate the possibility of simplifying the specification for the production of the primary standard by using a source that will give well-defined fringes with retardations greater than 200,000 wave-lengths. No action taken.

The discussion was opened by Mr Meggers, whose remarks are summarized as follows: In the Draft Report of 1928 (p. 84) recommendation No. 1 proposed "that the Union modify the provisional specifications adopted in 1925 for the production of the primary standard of wave-length so as to agree with those adopted in 1927

by the International Bureau of Weights and Measures." No action was taken at that time and the recommendation was omitted (p. 236).

The obvious intention of the originally proposed specification of the cadmium source was to base it upon the actual tube and operating conditions used for the comparison of the cadmium waves with the metre. This is the specification adopted by the International Conference of Weights and Measures. The specification adopted by the I.A.U. was less restricted, it does not exclude high-frequency excitation, it does not mention the volume or capillary bore of the tube, but requires that it must give interferences with differences of path of at least 200,000 waves. It has not yet been demonstrated that this simplified specification will yield a wave-length identical with the primary standard. The condition that the interference limit should be 200,000 waves may be criticized as unsatisfactory since it is less than half of the theoretical or actual limit of the Michelson tube, and amalgam lamps in which such a low limit is imposed by a relatively high pressure of *Hg* vapour have always yielded too large a value for the wave-length of the primary standard. Up to the present time the *Michelson tube* has always been used for the most precise comparisons of wave-lengths with metres and of wave-lengths of noble gas lines with the primary standard. The results have justified the retention of the red cadmium line as a reliable standard of length (Report, 1932, p. 59), and indicate that the cadmium, neon and krypton scales are identical within 1 part in 50,000,000 (Report, 1932, p. 76). Before any other cadmium lamp can be substituted for the Michelson tube it should be demonstrated that the wave-lengths do not differ by more than this amount.

It was moved (by Meggers) and seconded (by Saunders) that, in order to ensure continual exact reproducibility of the primary standard, and in order to bring the I.A.U. standard into agreement with that of the International Conference on Weights and Measures, Commission 14 recommend adoption by the I.A.U. of the specification adopted by the International Conference of Weights and Measures.

In discussion of this motion Mr Babcock advised delay on account of the absence of so many members of the committee. Mr St John raised the question as to whether the volume of the *Cd* tube should be greater or less than 25 cm. Mr Babcock objected to the smaller tube on the ground that at high temperature it might entail excessive vapour pressure which would affect the primary standard. Mr Carroll pointed out that tubes of larger volume would be subject to the same objection if a proportionately larger amount of *Cd* metal were introduced. Mr Babcock suggested that the amount of *Cd* metal to be used in the lamp be written into the specification. Mr Meggers expressed the opinion that neither volume of tube nor mass of metal will introduce a pressure effect if the tube is operated at the specified temperature (about 320° C.) but that the restricted volume is preferred because (1) it corresponds to the Michelson tubes actually used, and (2) it is advisable from the standpoint of temperature control and protection of interferometers from excessive heat radiation. The motion to adopt the International Congress of Weights and Measures specification was voted upon and lost.

2. It is recommended that, in order to improve the relative wave-lengths obtained from the standard iron arc in air and the arc *in vacuo*, further determinations should be made of the term depressions due to a pressure of one atmosphere. Adopted.

3. It is recommended that three additional iron lines, 4063·597, 4071·740 and 4260·479 Å be added to the 1928 list of secondary standards. Adopted.

4. It is recommended that further interferometer measurements of the ultra-violet iron lines in Tables V and VII of the Report be undertaken by one or more observers. Adopted.

5. It is recommended that efforts be made to extend the table of term values of *Fe* I by precise measurements of the wave-lengths of lines on which additional term values are based. Adopted.

At this point in the proceedings Mr Babcock called attention to the fact that several recent determinations of the refractive index of air for $\lambda 6438$ are in excellent agreement but are about 1 part in 2,000,000 larger than the value obtained fifteen years ago (by Meggers and Peters) and adopted by the I.A.U. in 1925. Mr Meggers commented that no explanation for this discrepancy was apparent but the difference is unimportant for the reduction of 3-decimal values from air to vacuum since the uncertainty of the air value may be of the same order. Even the primary standard appears now (Report, p. 59) to be uncertain in the third decimal, and it should be remembered that all wave-lengths are compared in humid air but reduced to vacuum by data applying to dry air because no convenient data for the dispersion of water vapour are available. It was suggested that a new determination of the dispersion of dry air and a similar one for water vapour may be desirable especially if data on the refractivities can at the same time be extended to shorter and to longer waves.

6. It is recommended that, in order to provide accurate term values for the computation of additional standard wave-lengths in the extreme ultra-violet, precise determinations of additional lines in the *Fe* II spectrum should be undertaken. Adopted.

7. It is recommended that the wave-lengths of the group of krypton lines in Table IX of the Report be provisionally adopted as equal in weight to the neon standards. Adopted.

8. It is recommended that observers be encouraged to continue precise determinations of the wave-lengths of lines of elements other than iron, among which copper would appear to be of special value in relation to the computation of wave-lengths in the far ultra-violet. Adopted.

Mr Meggers suggested that the use of vacuum sources was implied in this recommendation, and Mr Babcock stated that investigations of both air and vacuum sources are desirable for data on term depressions due to a pressure of one atmosphere.

9. It is recommended that continued efforts be made to extend interferometer measurements of the spectrum of the Sun, of the iron arc and of the noble gases as far as possible towards the infra-red. Adopted.

Mr Babcock reported that preliminary values of solar spectrum standards in the interval 7333.684–11204.87 Å had been determined at the Mt Wilson Observatory; these are presented in Table XV in the Report. It was emphasized again that wave-lengths in the revision of Rowland's table are on the scale of 1922, but the red and infra-red data appearing in the supplement are on the scale of 1928. A table of 4000 lines describing the solar spectrum between 7330 and 9000 Å will be published in the near future.

Mr Meggers announced that preliminary values and classifications for infra-red arc lines of iron, cobalt, nickel, titanium and zirconium will appear in the September

issue of the *Bureau of Standards Journal of Research*. Extension of photographic observations and classifications of rare gas spectra beyond 12000 Å was also reported.

10. It is recommended that further investigations be made of the differences in wave-lengths of lines observed at the centre of the Sun and those measured with integrated sunlight. Adopted.

Mr Dingle suggested that observations of limb and cusp spectra during solar eclipses would be of interest in this connection and Mr Babcock advised co-operation with the Solar Physics Eclipse Committee.

11. It is recommended that observers possessing gratings suitable for the purpose should give attention to the weak solar lines of wave-lengths greater than 6000 Å. Adopted.

12. It is recommended that intending observers should endeavour, through the President of the Commission, to reach some understanding as to the distribution of the work necessary to give effect to the foregoing recommendations. Adopted.

Mr Babcock promised to continue the work of measuring standards in infra-red arc and solar spectra at Mt Wilson. Mr Meggers stated that no facilities were at hand for the determination of solar spectrum standards at the Bureau of Standards but that interferometer measurements in arc spectra of metals and of gases would be pursued both in the infra-red and in the ultra-violet. Spark spectra in the ultra-violet will also be investigated.

Commission 16. (PLANETS, COMETS AND SATELLITES.)

PRESIDENT: Rev. T. E. R. Phillips.

SECRETARY: Miss M. Harwood.

Two meetings of Commission 16 were held. The Commission met also with Commission 22 to confer concerning the advisability of transferring the Physical Observation of Comets to Commission 22. It was decided not to recommend any change.

The Draft Report was amended and approved.

It was voted that the President of the Commission appoint a secretary to circulate information or requests for co-operative work on comets. It was agreed that the President appoint a special committee from the members who are observers of Mars to consult on Martian nomenclature and to report recommendations to the next meeting of the International Astronomical Union.

Recommendations. The following recommendations for future work were adopted by the Commission.

Visual observations of the planets should not give way entirely to photography. In the case of Mercury, it is advisable that the suspected variations of the dusky regions be followed throughout its orbital motion. And on the Moon the variation in the extension of the bright aureolas surrounding small lunar craters should be studied.

It is essential that visual observers give special attention to the motions of markings in the S. Tropical, N. Temperate, and N.N. Temperate regions of Jupiter. A discussion of the variations of the latitudes of the Jovian belts should be undertaken. Since Jupiter will soon be south of the equator, it is important that as