

cordingly I might with more advantage lay general stress on the importance of the practical applications of geometry. In doing this, I have possibly had the future of Gresham College more in view than my own candidature for the lectureship in geometry.

But I believe that, quite apart from the present election, the College has a future worthy of its earliest days, and that, not improbably, this future, if in another field, will still lie within the same broad lines that the City has already laid down for itself in the matter of technical education, the motto of which I take to be: Practice enlightened by theory, theory guided by practical needs. Work on such lines as these, accompanied by the expansion due to modern scientific requirements, would, I fully believe, restore the College to something like its old position among the teaching bodies of London, and reverse the judgment of that Cambridge historian of mathematics who has recently remarked that, "with the beginning of the eighteenth century, an appointment at Gresham College ceased to be a mark of scientific distinction."

#### THE PHOTOGRAPHIC CHART OF THE HEAVENS.<sup>1</sup>

THE publication of the fifth fasciculus brings us within reasonable distance of the actual commencement of the celestial chart, and the centre of interest is shifted from the theoretical speculations which have characterized the earlier publications to the more practical details suggested by the employment of the photographic instruments in those Observatories which are now equipped for the undertaking.

After three years of anxious organization, Admiral Mouchez sees the goal for which he has laboured so strenuously well in view. We may offer him our congratulations on what may be regarded as the completion of the first, but not the least arduous, portion of the task he has undertaken. He has succeeded in binding together, with a common aim and with unity of purpose, the astronomical energies of various nationalities, and, mainly through his exertions, the reputation of many Observatories stands pledged to complete the scheme which he has originated.

That great tact and delicacy have been necessary to carry the initial proceedings to a successful issue will be readily granted. Possessed as the French were with the typical photo-telescope, it would have been possible—nay, it might have been expected—that the Paris astronomers would have conducted a series of inquiries and experiments which would have enabled them to insist upon the exact arrangement of many details, and thus practically to exclude the judgment and participation of those Observatories whose equipment was less complete. But, with a delicacy which some might think almost to border on indifference, the French astronomers have nowhere taken advantage of the early possession of their photo-telescope to enable them to anticipate the researches of their collaborateurs. This policy of affording a fair start to the many participants will prevent any step of real practical importance in the actual photographing of the zones being undertaken till after another general Conference has met and deliberated. The invitations for this Conference have been issued for March next.

But if the French astronomers have been willing to efface themselves to some extent, in order to advance the scheme in which they are so much interested, it must be admitted with gratitude that they have been at all times willing to submit to various astronomers negatives, taken with the Paris instrument, for the discussion and decision

of questions of the first importance. In this connection we may notice the valuable discussion on photographic images, and the accuracy of their measurement at considerable distances from the centre, due to Prof. Bakhuizen. To the same astronomer, and again employing materials placed at his disposition by the Paris authorities, is due a valuable paper on the actual measurement and determination of the co-ordinates of 341 stars, with the comparison, wherever possible, with meridian observations; thus affording a practical measure of the accuracy likely to be attained in the catalogue places deduced from the measured negatives.

These and other inquiries of scarcely less interest and importance have appeared in the earlier fascicules published under the auspices of the Permanent Committee. One of the aims of this Committee appears to have been to collect in one convenient summary the whole of the literature which bears on the question of the photographic chart. Consequently, many papers which have appeared from time to time in other periodicals are reproduced here, either complete, or as abstracts. To these papers no reference need now be made. It will, however, be a matter of sincere regret to many astronomers, that no account is given of the experiments which, it is understood, have been carried out by Dr. Eder, under the auspices of the Committee. These experiments were undertaken with the view of determining the best method of preparing and developing the sensitized plates to be used in the chart. The results of an investigation conducted by so able and experienced a photographer as Dr. Eder were expected with considerable interest; and the omission of any reference to his results is the more to be regretted, since it was announced in September 1889, that the experiments were complete, and that the manuscript giving details would be forwarded to Paris in a fortnight. We may hope that the absence of any reference to Dr. Eder's work is caused by a simple delay, and does not indicate an abandonment of the inquiry.

Among the original papers which add an importance to the fifth fascicule are two contributed by the Astronomer-Royal, and which mark a distinct progress in the settlement of the preliminary details. In the first of these are reported the conclusions arrived at by a Committee appointed to consider the method of choosing the co-ordinates of the centres of consecutive plates. The problem the Committee had to solve was, how to fit, with the least possible loss of plates, and with the greatest convenience to the observer, a series of square plates to the concave surface of a sphere. It is evident that, as the declination increases, very different angles of right ascension are covered by the plate, and that even on the same plate, since the side covers 2°, the top and bottom of the plate will not occupy the same arc of right ascension. At 45° declination, the northern edge of the plate will correspond to six minutes more of R.A. than the southern, and of course, at greater declinations, the want of uniformity in this respect becomes more and more marked. The difficulty is not diminished by a decision of the Permanent Committee, that a second series of negatives should be taken, in which a corner of the plate in the first series should be made to coincide with the centre of a plate in the second series. Under these circumstances, the Committee submit two slightly different schemes. In either of these methods the centre of the plate will be made to correspond to the beginning of a minute of right ascension.

But to maintain this convenient rule, and at the same time adhere rigorously to the recommendations of the Conference, it would be necessary to arrange the zones photographed in such a manner that the breadth of the zone should be such that an arc of 2° of a great circle covers an even number of minutes of R.A. The Committee therefore contemplate the possibility of slightly relaxing the decisions of the Conference, and to so arrange

<sup>1</sup> "Bulletin du Comité International Permanent pour l'Exécution Photographique de la Carte du Ciel." Cinquième fascicule. (Paris: Gauthier-Villars et Fils, 1890.)

the zones that, when an odd number of minutes of R.A. is covered in the first series, it shall no longer be necessary to commence the second series at the half-minute, which would insure the exact coincidence of the corner of the first plate with the centre of the second, but to make the co-ordinates of the centre of each plate in the second series correspond to the nearest minute, midway between the extreme times covered on the first plates. The advantage of the alternative scheme proposed by the Sectional Committee is that a smaller number of plates will be required to cover the heavens. To photograph the whole sphere twice over with plates each of which accurately delineates four square degrees, and the sides of which nowhere overlap, would require 20,802. If the project of the "even minutes" and the recommendation of the Permanent Committee be strictly enforced, the number of plates required is 22,474; but if the alternative scheme of the Sectional Committee is adopted, this number is reduced to 22,054. The scheme founded on the employment of the mean minute is drawn up in detail, and seems to leave nothing to be desired, and it is sincerely to be hoped that the Permanent Committee will see their way to modify the resolution to which they have already agreed.

It is doubtful, however, whether the Committee will appreciate the advantage of reducing by about 2 per cent. the number of plates to be taken, involving as it does a reconsideration of their recorded decision. On another matter, there is exhibited a stout determination to uphold the resolutions in their integrity; and the spirit of loyalty to the decisions of previous Conferences may outweigh the expediency of reducing the labour of taking the negatives. In another paper the Astronomer-Royal has been bold enough, on sufficient grounds as it will no doubt appear, to recast the arrangement of the zones allotted to the participating Observatories. This proposed alteration has already called forth a protest against any change in the resolutions already carried. Admiral Mouchez, however, is adverse to a blind adherence to those early decisions. Infallibility, he remarks, does not obtain in science, and he advises the Permanent Committee to retain in its own hands any powers of modification and correction which may assist the onward progress of the work. The propriety of such a course seems to go without saying. It could never be sufficiently regretted if the decisions of immature experience limited and controlled the proposals of ripened judgment and more extended practice.

In the remaining portion of the fascicule, the subject of magnitudes is treated at considerable length, and from various points of view. Several resolutions have been adopted with the view of securing on the negatives, from which the catalogue is to be deduced, the images of stars of the eleventh magnitude; and in order that there may be no elasticity about the term "eleventh magnitude," it is proposed that the scale of Argelander shall be prolonged beyond the ninth, by increasing the time of exposure in the same ratio at which the light of a star diminishes between successive magnitudes of Argelander's scale, namely 2.5. It seems to have been the intention of those responsible for the application of this principle, that each observer is required to determine the time necessary to secure an image of a ninth magnitude star, and to prolong the exposure for the tenth and successive magnitudes by the continued employment of the coefficient 2.5. Whether this be the appropriate coefficient to ensure the reproduction on a negative of stars of a definite degree of brightness, as recorded by photometric methods, is open to question. A still larger coefficient necessitating longer exposures has been suggested, and further experiments in this direction are much needed. But admitting the theoretical accuracy of the scheme, its practical realization is surrounded with many difficulties, and while acknowledging the laudable effort on the part of the Com-

mittee to secure a strict uniformity of magnitude on the plates, it is doubtful whether, without some supplementary aids to observers, the surest method has been taken of carrying that intention into effect.

Foreseeing some difficulties in realizing the aim of the Committee in this direction, M. Trépied has proposed to construct, and to put into the hands of observers, photographic types of stars of the eleventh and fourteenth magnitude, in order that they may convince themselves after the development of a negative, that the prescribed limits of magnitude have been reached with a sufficient degree of approximation on each plate. He proposes to obtain, by photographing in various parts of the sky, an average conventional type of the photographic images of stars of the ninth, eleventh, and fourteenth magnitudes, all based upon the time in which the ninth magnitude star can be photographed. It will therefore only be necessary, he conjectures, for the observer to compare the images of the ninth magnitude star, when, if a similarity of appearance with the normal type results, it may be inferred that stars of the fainter magnitudes will be visible. It is a practical attempt to solve a difficult problem, and it is to be hoped the method may have a fair trial.

It is here presumed that the scale of magnitudes which obtains in photometry will be prolonged as far as the fourteenth magnitude. This point, however, has not been definitely settled by the Committee, and there are not wanting astronomers, of whom Prof. Holden is the principal exponent in this volume, who are in favour of an entire reconstruction of the system of magnitudes now in vogue, and for which this great undertaking, inaugurated under the auspices of Admiral Mouchez, offers an opportunity which is not likely to occur again.

W. E. P.

#### NOTES.

THE Chemical Society, having been founded in 1841, is in the fiftieth year of its existence and is the eldest among Chemical Societies. To celebrate this important occurrence in the history of the Society, it has been arranged that on February 24, at 3-5 o'clock p.m., a meeting shall be held at the Society of Arts, where the original meeting took place on February 23, 1841, at which the formation of the Society was decided on. At this meeting various addresses will be delivered, and delegates from other Societies will be received. On the evening of the same day, at 8.30 o'clock, the President and Council will hold a reception at the Goldsmiths' Hall, which has been most kindly placed at the disposal of the Society for the purpose by the Worshipful Company of Goldsmiths. On the evening of February 25, at 6.30 for 7 p.m., the Fellows and their friends will dine together at the Hôtel Métropole.

THE changes consequent on the retirement of Prof. Oliver, the late Keeper of the herbarium and library in the Royal Gardens, Kew, have now been completed. Mr. J. G. Baker, F.R.S., the Principal assistant, becomes Keeper; Mr. W. B. Hemsley, F.R.S., the Assistant for India, becomes Principal assistant; and Dr. Otto Stapf, Privat Dozent in the University of Vienna, Assistant for India. Mr. Hemsley is well known in the botanical world as the author of the botanical part of Godman and Salvin's "Biologia Centrali-Americana," of the Report on the Botany of the *Challenger* Expedition, and of the "Index Floræ Sinensis" still in progress. Dr. Stapf is the author of a monograph on *Ephedra*, and has travelled for botanical purposes in Persia.

THE Bentham Trustees have secured the services of Prof. Oliver as consulting botanist; he will also edit Hooker's "Icones Plantarum," which is now published for the Trustees under the authority of the Director of the Royal Gardens.