The Edinburgh Meeting of the British Association.

THE preliminary programme and invitation circular for the eighty-ninth annual meeting of the British Association, to be held in Edinburgh on September 7–14, is now ready for distribution. Members of the Association will receive it shortly if it has not already reached them; others who propose to attend the meeting may obtain a copy on application to the Assistant Secretary of the Association, Burlington House, London, W.1. The circular, which is more comprehensive than has been customary, contains more than a merely preliminary programme, for many of the definitive arrangements for the meeting are set forth and a time-table of the principal engagements is appended. The circular is a pamphlet of sixteen pages with a three-leaf cover. One leaf, detachable at a perforation, provides two reply forms —one for intimation of attendance and the other for intimation of the member's local address—and, in order to assist the organisation of the meeting, members who propose to be present are requested to complete and return these forms at their earliest convenience. On another cover is a useful map of central Edinburgh, on which are indicated the principal buildings, especially those to be used for the meetings, the railway stations, the 'bus and tram routes, and the principal hotels.

A prefatory note on Edinburgh is followed by the announcements regarding conditions of membership and railway communications. In the latter we note that the general officers of the Association have made, and will continue to make, every endeavour to secure a reduction of return fares for members attending the meeting, but up to the present they have been unable to obtain this concession from the railway authorities, and, failing the issue of a further intimation, it must be assumed that the concession formerly customary cannot be given this year. Enclosed in the circular is a printed slip directing attention to a proposal to run motor coaches from London (following routes *via* Oxford and Cambridge) and from Bristol, Liverpool, and other towns north of these, to convey members to Edinburgh, and back again if so desired. The fares would be approximately two-thirds of those charged by the railways in each case. The motor coaches would leave London and points south of Liverpool on September 5, completing the journey to Edinburgh in two days, and arrangements would be made for hotel accommodation *en route*. From Liverpool, Manchester, Leeds, and points north thereof the journey to Edinburgh would be made in one day—September 6. Passengers' luggage would be collected and delivered, each passenger being allowed 56 lb. free of charge. This enterprising project can be realised only if the transport company has a guarantee as to the number of members who would be prepared to avail themselves of it, and members are therefore requested to state on their intimation forms if they would make use of the motor service.

The programme gives the titles of the addresses, discourses, and principal discussions. The presidential address by Sir Edward Thorpe will deal with some aspects and problems of post-war science pure and applied. The evening discourses are on subjects especially appropriate to a meeting in Edinburgh. Prof. C. E. Inglis will make a comparison of the Forth and Quebec bridges, showing the evolution of cantilever-bridge construction during the past thirty years; and Prof. W. A. Herdman will give an account of the important part played by Edinburgh in the progress and development of the science of oceanography.

The sectional presidents' addresses will cover a wide range of subjects; for example, the laboratory of the living organism, the boundaries of physiology, experimental geology, evolution, the theory of descent in relation to the early history of plants, the study of native races, consciousness and the unconscious, the place of music in a liberal education, water-power, the principles by which wages are determined, and agricultural economics. Several of these addresses are to be introductory to discussions. The president of the Conference of Delegates of Corresponding Societies is to give an address, followed by a discussion, on "Science and Citizenship." Arrangements have been made for a number of joint sectional discussions, and the following are announced as the respective subjects: The structure of molecules, the age of the earth, biochemistry, the proposed mid-Scotland canal, the origin of the Scottish people, and vocational training and tests. The times of the sectional presidential addresses and of the principal discussions have been arranged so that those on cognate subjects are not held at the same hour; for instance, the addresses are distributed over the Thursday, Friday, and Monday mornings, and not more than two are at the same hour.

From this summary it will be evident that the arrangements for the meeting are in an advanced stage, and we understand that this is also the case in regard to the programme of papers to be presented to the various sections.

The forthcoming meeting in Edinburgh—restored to its pre-war length of a full week—promises to be one of great scientific interest and value, and all well-wishers of the Association are looking forward to a full resumption of the activity and influence of the Association

The Royal Observatory, Greenwich.

THE visitation of the Royal Observatory took place on June 4, when the report of the Astronomer Royal, which covers the year ended on May 10, was presented. The report states that strenuous efforts are being made with the transit circle to complete the present catalogue, which embraces some two thousand stars of the list prepared by Dr. Backlund and Mr. Hough; the aim of that list was to obtain a convenient number of reference stars uniformly distributed over the sky. These observations will be concluded at the end of this year, after which observations will be commenced of all stars down to magnitude 8·0 between N. declination 32° and 64°. It will be remembered that stars down to magnitude 9·0 between declination 64° and 90°, and also between 24° and 32°, have recently been observed at Greenwich. The catalogue of the last-named region was distributed during 1920; it includes the determination of the proper motions of 12,000 stars.

The mean error of the longitude of the sun, as given in the Nautical Almanac, is $-1\frac{1}{2}''$; that of the moon is $-13''$, which is deduced from observations on 114 nights. Eight occultations of stars by the moon were observed, and also both phases of the solar eclipse of April 8.

The 28-in. equatorial has undergone extensive repairs by Messrs. Cooke; observations of double stars have now been resumed. The working catalogue

has been drawn up with the idea of avoiding overlapping of observation and of including stars the orbit determination of which is hopeful. Many orbits of binaries have recently been computed by Mr. Jackson, who has also, together with Mr. Furner, published an investigation showing that the mean mass of binary systems is double that of the sun. Working on this assumption, hypothetical parallaxes have been deduced for several hundreds of stars. The observations with the 28-in. equatorial since 1893 have been collected into a volume, which is nearly ready for publication; it also contains the orbits found by Mr. Jackson, and notes on the relative motion in cases where orbits cannot yet be determined.

The programme of parallax determination with the 26-in. equatorial is being continued. The plan of taking double exposures on the same plate at six-month intervals has been dropped; each plate is now developed after exposure. Fiducial plates of each field are prepared by making rulings with a diamond in the positions of the parallax star and reference stars; all the plates are compared in succession with the appropriate fiducial plate. Forty-nine parallaxes have thus been deduced in the year, the number of plates measured being 829; the probable error of a determination is 0·009″.

There are two extensive investigations in progress with the aid of diffraction gratings. The grating employed with the astrographic equatorial gives a first diffracted image 2·83 magnitudes fainter than the principal image. By successive steps it is possible to compare the magnitudes of all stars within the range of the instrument. The magnitudes of the stars in the Harvard polar sequence are being re-determined. The results obtained so far confirm the Harvard scale for the fainter stars, and the Mount Wilson one for the brighter.

The grating on the 30-in. reflector is being used to obtain the effective wave-length, and hence to infer the spectral type, of the stars in the Greenwich astrographic zone (declination 64° to 90°). An exposure of seven minutes suffices to give satisfactory results for stars of magnitude 10·5. Effective wave-lengths have already been determined for 550 stars within 3° of the Pole, the mean probable error being 10 angstroms.

The astrographic equatorial will shortly be dismounted in preparation for its removal to Christmas Island for next year's eclipse. Sir Howard Grubb and Sons are making an equatorial mounting for use there, as the cœlostat method proved unsatisfactory in 1919 for a problem involving such great precision as the investigation of the Einstein bending of light. Mr. Jones and Mr. Melotte will start for Christmas Island early next year, and remain six months on the island. The fact of having an astrographic equatorial close to the equator will be utilised for taking series of photographs for the purpose of comparing the magnitude scales of northern and southern zones.

The Reid and Pons-Winnecke comets have been observed both visually and photographically on several nights. The first photograph of the latter was secured within a few hours of the receipt of Prof. Barnard's telegram announcing his detection of the comet.

The usual magnetic and meteorological observations have been continued. The mean magnetic declination for 1920 was 14° 8·7′ W.; it is diminishing by 9½′ annually, which will bring it to zero about the close of the century. The chief magnetic disturbance was from March 22 to 25, 1920, being associated with a large group of sun-spots. The mean temperature for the first four months of 1921 was the highest for that period during the last eighty years, January being 7·5° above the average. The rainfall was 18·77 in., being 5·47 in. below the average of seventy-five years. July and September alone were above the average.

The Astronomer Royal refers to the success attained by Mr. Bowyer in the mechanical registration of wireless signals on a siphon recorder. Signals are received from the Eiffel Tower, Nauen, Annapolis, Darien, Bordeaux, and Lyons; some special series were sent from Lyons for the determination of Australian longitudes. These were recorded both at Greenwich and in Australia.

A. C. D. C.

The Chinese Earthquake of December 16, 1920.

By DR. C. DAVISON.

A PRELIMINARY report on the destructive Chinese earthquake of December 16 last has been prepared by Father E. Gherzi, and is published by the Zi-ka-wei Observatory. Though brief, it is of considerable interest, as it is the first scientific account that we have received of this great earthquake. The report is based on the letters received from correspondents of the observatory (nearly all missionaries), on articles in Chinese and other newspapers, and on the seismograms provided by the Wiechert astatic pendulum (mass 1200 kg.) at the observatory.

The first shock registered there occurred on November 16, others on December 4, 6, and 10, and possibly three early on December 16. The primary waves of the great shock arrived on that day at 12h. 9m. 16s., and the secondary waves at 12h. 11m. 45s. In less than two minutes later one of the recording levers was dismounted, and after 3½ minutes more the other passed off the paper and was put out of action. Such as it is, the seismogram shows that the epicentre was about 1400 km. from Zi-ka-wei, and that the time at the origin was 12h. 6m. 5s. (G.M.T.).

The area most strongly shaken lies in the provinces of Kansu and Shensi, in the north-west of the country, in which are situated the origins of the most disastrous of Chinese earthquakes. From the somewhat scanty materials at his disposal, Father Gherzi has constructed the probable courses of the isoseismal lines, using the Mercalli scale. The curves of chief interest are those of degrees 10 and 9. The former surrounds all the places at which the destruction of buildings was total or nearly so. It includes the towns of Pingliang, Kingchow, Kuyuan, and Tsingning-chow, and covers a district about 180 miles long, 60 miles wide, and more than 8000 square miles in area. Its longer axis is directed N.N.W. and S.S.E., and is roughly parallel to the axes of the great crust-folds of this region. Assuming this isoseismal to be drawn correctly, it follows that the position of the epicentre is about 35·8° N., 106·2° E.

As in all earthquakes of the first magnitude, the duration of the shock was considerable—according to one observer, who measured it, certainly three minutes. Throughout all this time the shock seemed to vary but little in intensity, though becoming slightly stronger near the middle. The effects of the shock were aggravated by the structure of the country—the rock in the central area being capped by a thick bed of loess, through which the streams have worn ravines with nearly vertical sides. Roads are said to be cut up