Over England the plan position of the intersection at 60 miles high runs nearly parallel to the 0.98 totality line to the south of the central track. It is for most of the distance between the Bristol Channel and the North Sea, within 2 to 5 miles of this line and to the south of it. The location at 5^h 20^m is shown in the lower margin of the illustration, and that at 5^h 22^m is near the east coast. It is interesting to note that according to the data used in the computation, the centre of the shadow has not reached the earth's surface at 5^h 20^m, its nominal time of contact being 5^h 20.1^m.

The season and the early time of day at which the eclipse takes place, being before 6 A.M. by solar time for first, second, and third contacts, causes the lines indicating simultaneous maximum phase on the map to be displaced more than 90°

from the lines of longitude to which they approximate later in the day where the eclipse takes place at local noon. The map (Fig. 2) shows the shape of England as viewed in the direction of the shadow axis, the plane containing the earth's axis being imagined to indicate the vertical.

Arrangements have been made for the party organised by the Physical Society of London to have the use of accommodation at the Race Course at Richmond. The times of the contacts and position angles are shown in Fig. 3. The computation has been made taking into account the corrections given by Dr. Comrie, as a result of the information recently provided by the Astronomer Royal. The difference between the position angles of second and third contacts, 185°, being larger than 180°, shows that the point is a few hundred yards to the north of the centre line.

Astronomical Programmes of Eclipse Work.

By F. J. M. STRATTON.

ALTHOUGH the Joint Permanent Eclipse Committee has organised no special expedition to observe the eclipse of June 29, it has arranged that all instruments in its charge should be employed at the eclipse and has acted as an intermediary in securing instruments and local facilities for various expeditions. Ready co-operation has been invariably met with locally.

The first eclipse camp on the track of which the programme details are available is at Llysfaen Head, near Colwyn Bay. Here Dr. R. J. Clark, of the University of Edinburgh, Prof. H. Dingle, of the Imperial College of Science and Technology, South Kensington, and a group of research students from the University of Cambridge, will be stationed. A 16-inch cœlostast will be used to feed two spectrographs—a slit spectrograph working with a very dense flint Parsons prism, and an objective grating-spectrograph using a parabolic grating lent by Mr. Merfield of Melbourne, especially ruled to be strong in the infra-red of the first order and the ultra-violet of the second order. Abney plates will be used, and it is hoped to extend the spectrum of the chromosphere, and if possible of the corona, well beyond $\lambda 10,000$. Wireless experiments on the strength of signals will also be carried out. Prof. Nolan from Dublin will also be at Colwyn Bay studying atmospheric electricity during the eclipse, and possibly President Morehouse from Des Moines University, Iowa, may be there with a spectroscopic programme.

Where the eclipse track strikes land again at Southport, the Oxford expedition under Prof. H. H. Turner and Dr. H. Knox-Shaw will be stationed. Their programme consists of direct photography of the corona together with photographs in polarised light. At Stonyhurst, Father O'Connor will also be taking direct photographs of the corona and flash spectra, working so far as possible into the

infra-red. It is understood that Prof. da Costa Lobo, Director of the Coimbra Observatory, Portugal, will be at Stonyhurst with a cinema camera and spectroscopic apparatus.

The expedition from the Royal Observatory, Greenwich, will be in the grounds of Giggleswick School, near Settle. Its programme consists of direct photographs of the corona with a 6-inch lens of 45 ft. focal length, the spectrum of the chromosphere in the extreme red and a comparison of the intensities and heights of H and K and of the Ca⁺ triplet ²D – ²F at $\lambda\lambda$ 8498, 8542, 8662.

Mr. Evershed will be at Tunstall, about five miles from the central line, working with a large prismatic camera with two 6-inch prisms of 45° angle and a lens of 21 ft. focus. He will be studying the cusp spectrum before and after totality and the flash spectrum, and will be largely concerned with the height of the various gases. The Norman Lockyer Observatory expedition will be between Gilling and Richmond with a programme of direct photographs of the corona and small-scale spectra. Other observers who are expected to carry out observations in the belt of totality in Great Britain include Mr. Albert Taylor at Llanbedrog, Prof. E. A. Owen at Bangor, Mr. Harold Thomson and Mr. F. Sargent, of the Observatory of Durham, at Catterick, Dr. F. W. Aston and Mr. Wilfrid Hall also in Yorkshire. Prof. A. Fowler at the Imperial College of Science and Technology, London, and Prof. R. A. Sampson at Edinburgh, are proposing to study the cusp spectrum with high dispersion spectrographs during a considerable interval on either side of the time of maximum eclipse.

The other British expedition is that of the Solar Physics Observatory, University of Cambridge, which proceeds under Prof. H. F. Newall to Aal, in the Hallingdal in Norway. In addition to direct

photographs of the corona the programme includes spectroscopic observation of the chromosphere in the ultra-violet and the infra-red, with special application to the relative intensities of the red calcium triplet and of H and K. The intensities of lines at different heights will also be studied. Spectrophotometric work will figure largely in the programme, and there will also be polariscopic observations and interferometer photographs of the corona.

The American expeditions are all, except that of President Morehouse, to be stationed in Scandinavia. Prof. H. T. Stetson, of Harvard Observatory, and Mr. Weld Arnold, will be doing photometric work on the total brightness of the corona at Fagernas, where Prof. S. A. Mitchell, of the Leander McCormick Observatory, will also be stationed. Farther north, possibly near Gellivare, will be the Dutch expedition, including Dr. Minnaert, with

the spectrophotometric programme which they were prevented by clouds from carrying out in Sumatra last year. Dr. Luyten will accompany this party. In addition to Prof. Stetson's photometer and the Dutch instruments, it is understood that Dr. Anderson's eclipse spectrograph, which was also blocked by bad observing conditions in Sumatra, will again be brought into use, in the hands of Dr. S. Rosseland. Finally, an Italian expedition under Prof. Horn d'Arturo may be stationed in Norway, and it may be assumed that there will be several Scandinavian expeditions and German expeditions in Scandinavia also. Details of their plans have not come to hand.

Nowhere along the track can it be said that weather prospects are very good. On the other hand, they are not so bad that we may not expect fairly confidently results of value from some of the many expeditions that will be observing the eclipse.

Observing Parties and Stations.

THE NORMAN LOCKYER OBSERVATORY.

DR. W. J. S. LOCKYER, director of the Norman Lockyer Observatory, informs us that the expedition from the Observatory will occupy a site on the eastward and adjoining side of a good road connecting Richmond with Gilling village, and distant one mile from the market place of the former town. It is on the Marquess of Zetland's estate, and he has very kindly given permission for the Observatory's party to take up its position there. The site is situated on a 600-foot contour line, and looking away from it towards the north, through the east and to the south, the ground falls away sharply at first and gradually afterwards. In fact, there is no land reaching anywhere near 600 feet within twenty miles of a line drawn due east and twenty-five miles a little north of east.

The programme of work to be attempted at Richmond is to secure large- and small-scale photographs of the corona, chromosphere, and prominences, and also a photograph of the spectrum of the corona.

The conditions of the eclipse are not sufficiently favourable to warrant the transport of a large spectrograph for photographing the chromosphere at second and third contacts. As such photographs can be obtained at stations where the partial phase is very large, arrangements have been made to accomplish this at the Sidmouth Observatory, where a large spectrograph is available.

Time determinations of the contacts will also be attempted, use being made of the broadcast time signals for checking the rate of the chronometer. The large-scale photographs of the corona will be taken with a camera the lens aperture of which is 6 inches, having a focal length of 31.5 feet, giving a solar image 3.3 inches in diameter. This instrument will be rigidly oriented to the eclipsed sun, the photographic plate only being moved by mechanism. One exposure only will be made.

Two smaller coronagraphs will in addition be

mechanically driven, one having a 6-inch aperture and 4 feet focal length and mounted equatorially, and another a $3\frac{1}{4}$ inch Dallmeyer rectilinear lens of 15 inch focal length mounted on a 12-inch siderostat. One plate will be exposed in the latter and two or more in the former.

Four or more other coronagraphs from 4 inches aperture or less, including a Zeiss triplet aeroplane lens working at f 4.8 and an Aldis triplet aeroplane lens working at f 5.6, will be fixed in position, and two or more plates will be exposed in each, with exposures of two seconds or less.

The large-scale photographs of the chromosphere and prominences will be taken with a 30-foot coronagraph, giving an image of about 3 inches. This instrument will be fixed in the direction of the eclipsed sun, and the exposures given will be very short. Altogether about eight exposures will be attempted.

To secure the spectrum of the corona on a small scale, a Thorp transparent grating mounted in front of a Zeiss triplet aeroplane lens working at f 4.8 will be used. This instrument is mounted on the upper end of the polar axis of a 12-inch siderostat and is clock-driven. One exposure only will be made of the coronal spectrum in the first order of the grating.

The party from the Norman Lockyer Observatory will consist of Lieut.-Col. Sir Francis McClean, Capt. W. N. McClean, and Dr. W. J. S. Lockyer, but much additional volunteer assistance will also be available to manipulate several of the smaller instruments and undertake other observations.

ROYAL OBSERVATORY, GREENWICH.

THE headmaster of Giggleswick School has kindly placed a field at the disposal of the Greenwich expedition. The observing party will consist of the Astronomer Royal, Dr. Jackson, Mr. Davidson, Mr. Melotte, and Mr. Woodman. Three different observations will be attempted.

(1) A large-scale photograph of the corona will be taken. For this a 6-inch lens of 45 ft. focus,