

Next Year's Total Solar Eclipse (September 21, 1922).

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IN September of the coming year there will be a very favourable total eclipse of the sun, and several expeditions are preparing to proceed to stations on the narrow track of the moon's shadow. This eclipse is a member of an important family, from the point of view of solar physics, because one of its predecessors was the memorable eclipse of August 18, 1868. On this occasion the astronomical equipment was enriched for the first time by the use of the spectroscope for such work, and the important discovery of the gaseous nature of the solar prominences during that eclipse was the forerunner of very rapid advances in solar research. The track of the shadow was slightly to the north of the coming one, and passed over North-East Africa, India, Java, and North Australia. It was in India that the memorable observations were made.

ing figure, and it will be seen that it affords four regions (marked with circles) well distributed along it from which observations could be made.

On the north-east coast of Africa the eclipse occurs when the sun is near the horizon, so this region is not favourable for observational work. Farther east, the Maldive Islands present a good station. There the sun is well up, having an altitude at eclipse time of about 34° , and the duration of the total phase is 4m. 10s. The weather prospects seem to be good. It is probable that special arrangements would have to be made to reach the islands, as there is no scheduled line of steamers. It is not yet known which of the islands will be occupied, but Admiral Sir A. Mostyn Field points out (Monthly Notices, R.A.S., vol. 81, No. 5) that care must be taken as regards selection owing to possible landing difficulties.

Thus in the case of the island of Dambidu (lat. $2^\circ 5' N.$, long. $73^\circ 34' E.$) charts seem to indicate a broad shelf of reef more than a mile in width, extending from the island on the lagoon side: the presence of coral heads separated by deep pools may therefore be expected. It is very probable that Mr. John Evershed, the director of the Kodaikanal and Madras Observatories, will proceed to this station, and his work will include spectroscopic observations on a large scale.

At Christmas Island, in the Indian Ocean, the sun will be well up towards the zenith—in fact, it

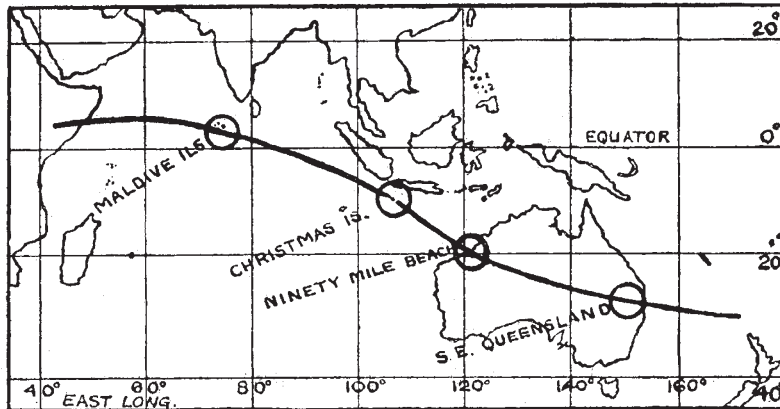


FIG. 1.—Shadow track during total solar eclipse of September 21, 1922.

The two immediate predecessors of the coming eclipse took place on September 9, 1904, and August 29, 1886. The first of these was confined to the Pacific Ocean, where no observations were made. The second commenced in the north of South America; the track then crossed the Atlantic Ocean, finally crossing South Africa, and terminating in Madagascar. Unfavourable weather prevented many observations being made:

The line of totality of next year's eclipse commences on the north-east coast of Africa, leaving it at Somaliland. It then cuts through the Maldive Islands, which lie to the south-west of India, skirts the East Indies, but passes over Christmas Island, which is situated about 200 miles to the south of the sound between Sumatra and Java. The line next strikes the Australian continent at a region called Ninety Mile Beach, crosses the continent nearly centrally, and leaves it at the coast of South-East Queensland. It ends in the ocean just to the north of the North Island of New Zealand.

The line of totality is shown on the accompany-

will be nearly noon there—and the duration of totality will be 3m. 40s. This island is not exactly in the centre of the zone of totality, but about fifty miles from this centre. The prospect of clear weather at this tropical island is only moderate, but from experience at such islands little dependence can be laid on average conditions of weather.

The British Joint Permanent Committee has decided to occupy this island. Two members of the staff of Greenwich Observatory, Mr. H. Spencer Jones and Mr. P. J. Melotte, have been chosen to proceed there to obtain the necessary photographs. The special object of this expedition is to make a new determination of the deviation of the light of stars in the gravitational field of the sun. The instrument to be employed is the 13-in. astrographic telescope on a special equatorial mounting. It may be remarked here that usually on such expeditions telescopes mounted equatorially are not used. The tubes containing the object glass and camera attachments are generally mounted horizontally, and the

light is reflected into them by means of a clock-work-driven plane mirror called a "siderostat" or "cœlostat." Unfortunately such mirrors, owing to changes of temperature, do not remain "plane," but become slightly curved, thus rendering it very difficult to keep the telescope in perfect focus. Pointing the telescope directly at the sun and keeping it clock-driven on an equatorially mounted stand eliminates all such difficulties.

Numerous photographs of the stellar field in which the sun will lie at the time of the eclipse have already been secured to compare with those that will be taken during totality. The expedition will reside six months in the island previous to the eclipse, and will, in addition to other work, make a comparison between the photographic scales of stellar magnitude in the north and south hemispheres. *Even if the eclipse be not observed owing to possible bad weather, some very useful work will have been accomplished. The Christmas Island Phosphate Company will assist the observers by levelling the site, erecting the concrete base for the equatorial, and putting up the necessary huts, thus rendering valuable assistance in the cause of astronomy. An expedition from Batavia, in Java, will also take up its station on this island. Mr. J. G. Voûte will be the leader, and the party may possibly camp near the Greenwich observers to take advantage of the available local assistance.

The region on the north-west coast of Australia, where the shadow next strikes land, known as Ninety Mile Beach, is perhaps the most favourable station from the point of view of weather. This area of the continent is excessively dry, and the percentage of cloudiness small. The sun's altitude will be 58° and the duration of totality will be comparatively long, namely, 5m. 18s., at a post station named Wollal. Wollal lies about 200 miles to the south-westward along the coast from Broome. Commercial steamers run from Perth to Broome, and at the latter place local small schooners or launches can be chartered to beach near Wollal. Prof. A. D. Ross and Mr. R. D. Thomson, of the Perth University, have published (Monthly Notices, R.A.S., vol. 31, No. 3) a large amount of useful local information about Wollal. Good water, fuel, and unskilled labour are available.

It is definitely known that a party of astronomers from the Lick Observatory in California, under the direction of Prof. W. W. Campbell, the director of the observatory, will take up their station there, and it is hoped that an Australian party will occupy a position on the west coast in addition to one or more on the east. The work of the American party will probably include in its programme the photography of the corona, and spectroscopic investigation of the chromosphere. In South-Eastern Queensland the shadow passes consecutively over Cunnamalla, Goondewindi,

Stanthorpe, and Casino. The first of these lies well inland to the south of Queensland, about 475 miles from the coast, and totality lasts 3m. 45s. This station is more difficult of access than the other three, but lies on the Western Railway of Queensland.

Goondewindi and Stanthorpe, 180 and 100 miles respectively from the coast, lie just to the north-west of the New England range, and the railway is also available. Casino, to the north-east of the range, and only thirty miles from the coast, is on the railway, and therefore quite easy to occupy. The nearer the coast is approached the more chance there is of unfavourable weather conditions, so the most distant inland station, Cunnamalla, is from this point of view the pick of these stations.

Mr. W. E. Cooke, the Government astronomer of New South Wales, has published a pamphlet, which is full of detail, of local notes on the selection of sites in Australia, and the large-scale map of the Queensland region which accompanies it should prove very useful. Mr. H. A. Hunt, the Commonwealth meteorologist, has also issued a weather card showing the duration of the wet seasons on the line of totality.

The Australians are very keen that British astronomers should take up their stations on their continent, for at a public meeting held recently at Adelaide under the presidency of the Governor, a resolution was adopted inviting British astronomers to view the eclipse there. It was urged that Australia was superior to Christmas Island because of the clear sky, particularly in the high northern district.

While reference has been made only to official expeditions which will be taking advantage of this favourable eclipse, there will no doubt be other parties which will proceed to one or other of the above-mentioned localities. The sun itself will most probably be in a state of quiescence, judging from the recent low activity of the solar atmosphere, and from the fact that the last maximum of spot disturbances occurred in the year 1917. Thus the form of the corona will most probably be of the "windvane" type, in which the coronal streamers are restricted to the lower solar latitudes, while the regions of both poles will be conspicuous by the presence of the well-known polar rifts.

It is well known that some eclipses are termed "dark" or "bright," according to the visibility of the distant landscape, near objects, or the face of a watch held in the hand. Owing to the low state of solar activity and to the long duration of totality, next year's eclipse would be expected to be of a "dark" nature. If this be so, then the coming event will be more favourable for photographing those stars that are apparently near the sun than was the case on the last occasion, when such successful photographs were secured for making one of the tests connected with the theory of Einstein.