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THE ECLIPSE OF THE SUN

THURSDAY'S GREAT SPECTACLE

WORK OF THE SCIENTIFIC STATIONS

All along the line of totality on Thursday Australians will be favored with a view of the grandest of all celestial phenomena, the sun in full eclipse. In this State dwellers southward of a line extending about 100 miles beyond Oodnadatta will have to be content with a view of the eclipse in its partial phases, which, however, will be sufficiently rare and impressive to arouse tremendous interest and excitement. The warning already given, regarding the need for

Dr. W. W. Campbell,
Director of Lick Observatory.

protection of the eyes, cannot be too often repeated. It should be borne in mind that serious and permanent injury to the sight may be caused by continued staring at the sun during the partial eclipse, even with the unaided eye, if it is insufficiently protected. Much more probable are ill effects if optical instruments, such as ordinary binoculars or telescopes are used. Very dark green or neutral tinted glass is suitable, or glass heavily smoked over a lamp or candle. For naked eye observations a dense portion of a photographic negative is sometimes suitable, but for use with optical instruments it is

Dr. J. H. Moore,
Lick Observatory.

advisable to have the proper solar eyepiece material, or black glass, such as is used by electricians as a protection against glare from arc lamps. If the only glass obtainable is not sufficiently dark it is an advantage to attach a larger piece of it to the objective, instead of the eye-piece of the instrument. The Commonwealth Meteorologist (Mr. H. A. Hunt) points out that glass of reddish tint is unsuitable. He recommends amateurs to use dark green glass, if it is procurable, or, failing that, pieces of clear glass darkened to the required density by the smoke of an lamp.

Prior to his departure for Cordillo Downs the South Australian Government Astronomer (Mr. G. F. Dodwell) gave the

Professor C. A. Chant,
Toronto University.

times by which the public may be guided in watching for the changes to occur. As viewed by people in Adelaide, the eclipse will begin at 2.22 p.m., attain its maximum phase (with three-quarters of the sun's disc obscured) at 3.32 p.m., and end at 4.36 p.m. These times will apply approximately to all the more settled portions of the State. Spectators in Adelaide will have rather a better view of the phenomenon than those in Perth or Melbourne, but will see it in a phase less complete than will Sydney and Brisbane people.

Although total eclipses of the sun occur at fairly frequent intervals in some parts

Mr. G. F. Dodwell,
S.A. Government Astronomer.

of the world, Thursday's event will be of unique importance in the Commonwealth. It will be the first total solar eclipse visible on the mainland of Australia since its earliest colonisation, and the next will not occur until 1976. Hence the supreme interest to this generation. In 1910 a total eclipse was observed from Mount Lyell, Tasmania, but in that year the astronomical expedition to Bruni Island met with adverse weather. The recognised possibility that the coming eclipse will be observable under the most favorable atmospheric conditions on the north-west coast of Western Australia and at selected stations in the interior accounts for the attention that is being concentrated upon the Australian observations and tests by learned bodies in other countries. It accounts also for the presence upon Australian soil of some of the world's greatest authorities in solar science, reinforced by the leaders in the same field of research from the observatories and universities throughout the Commonwealth. The most complete equipment is that set up by the Crocker Eclipse Expedition of the Lick Observatory (California) at Wallal (Western Australia), other stations at which important work will be done being Cordillo Downs (South Australia), Goondiwindi (Queensland), Coongoola (Queensland), and Stanthorpe (Queensland).

At Wallal the personnel of a large party of scientists includes Dr. W. W. Campbell (Director of the Lick Observatory), Drs. J. H. Moore and R. J. Trumpler (Lick Observatory), Professor C. A. Chant (Toronto), Dr. R. K. Young (British Columbia Observatory), Dr. C. E. Adams (New Zealand Government Astronomer), Professor A. D. Ross (Perth University), Mr. J. Evershed (Kodaikanal Observatory, Madras), Mr. J. B. O. Hosking (Melbourne Observatory), Messrs. J. Hargreaves and G. S. Clerk-Maxwell (British private expedition), and members of the Perth Observatory staff. The Lick observers have set up a photographic camera 40 ft. long, containing an objective of 5 in. aperture, with which large scale photographs of the sun's corona will be secured during totality. It is also the intention to photograph the crescent of the sun during the partial eclipse, shortly before and after totality, and to have the moments of these exposures recorded on a chronograph, so that they may serve to obtain the relative positions of the moon and the sun with great accuracy, and to check the correctness of the calculated motions of these two bodies. Several spectrographs will be used for studying the spectrum of the corona, and numerous minor observations have been planned.

The most important part of the programme, however, is the testing of Einstein's theory of relativity. According to this theory a ray of light passing near a heavy body like the sun should be deviated from its normal straight path by the gravitational action of the sun. Stars situated in the sky, close to the sun's disc, should then appear shifted from their normal places by certain amounts predicted by Einstein. It is only possible to observe or photograph stars close to the sun's edge during a total eclipse, when intense sunlight is shut off by the moon, and the eclipse on Thursday will offer a precious opportunity for testing this far-reaching theory. The photographs to be taken at Wallal will be compared with those taken at Tahiti some years ago by very accurate measures made with the aid of a microscope. For none of the stars the shift predicted by Einstein amounts to more than one-thousandth of an inch.

At Cordillo Downs there will be associated with Mr. Dodwell and Professor Kerr Grant, Messrs. A. L. Kennedy, A. G. Appleby, and E. A. Thrum, of the South Australian scientific party. Mr. Dodwell will photograph the corona with a duplicate of the Lick Observatory tower telescope, lent by Dr. Campbell, and will also test for the "Einstein effect" and record magnetic variation on the lines of the Carnegie Institute programme. Professor Kerr Grant will measure the active value of the sunlight and corona by photo-electric methods, and will undertake spectroscopic determinations. There will also be meteorological observations, and a reception of wireless signals in relation to the ionisation of the sun's rays.

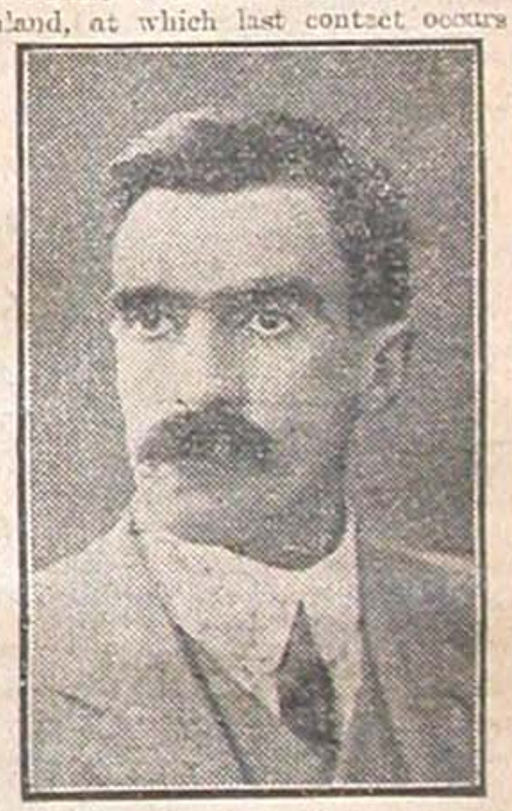
At Goondiwindi Dr. J. M. Baldwin, of Melbourne University, will devote attention to investigating the distribution and intesity of the light of the corona, using photographs in three different scales, the largest being a 4-in. diameter of the lunar disc given by the standard photo-heliograph fed from a caelostat. A diffraction grating will be used, with a caelostat in photographing the green and higher regions of the coronal spectrum. The programme of observations of magnetic declination proposed by the Terrestial Magnetism Department of the Carnegie Institute will also be carried out. Professor Cooke, of Sydney Observatory, will test for the Einstein effect, and also photograph the corona, in addition to obtaining a full positional history of the eclipse. Observations of the shadow bands and photographic record of the intensity of light during totality will be taken, and the width of the moon's shadow along the 153rd meridian will be determined. Professor Von Willer, of the Sydney University, will photograph the "flash spectrum" with a cinematograph camera, in order to obtain the fullest possible data of this evanescent phenomenon, and special attempts will be made to photograph the outer corona.

At Coongoola Mr. D. G. Coleman, of the Carnegie Institute, Washington, will observe the magnetic elements, and at Stanthorpe Mr. W. F. Gale and members of the British Astronomical Association will photograph the "flash spectrum" and corona, and will observe the shadow bands and coloration of stars near the sun. Mr. J. W. Hooke, general manager of Amalgamated Wireless (Australia), Ltd., on behalf of the Commonwealth Meteorologist, has arranged for a programme of signalling from Perth, Sydney, Townsville, Rabaul, and Nauru, to determine the effect on signal strength of the de-ionisation of the atmosphere due to the eclipse shadow. Other stations will listen for the variation in signals, and a large experimental plant will be used to measure the strength of the current induced on the aerial, in addition to determining any change of wave front due to the eclipse. Meteorological observers along the limits of the shadow band have been asked to report the actual boundary of the umbral cone within which totality is observed, and to record any meteorological phenomena.

The following interesting notes concerning the eclipse have been supplied by the West-terrace Observatory:—

An eclipse of the sun occurs when the moon intervenes between the sun and the point of observation. A person unacquainted with astronomy might expect this to occur at every new moon. Owing, however, to the inclination of the moon's orbit it occurs only when the earth is at one of the nodes of the moon's orbit, that is, points at which it crosses the apparent path of the sun it is generally known and easily observed that the sun and moon have about the same angular diameters in the sky. This means that teh ratios of their actual diameters to their distances from the earth are about the same. As the sun is by far the greater body and the source of light, a shadow cone will always be cast by the moon on the side away from the sun. It is the "chance" agreement in the angular diameters of the two bodies that causes the tip of this shadow cone to fall near the earth at time of solar eclipse. The moon's orbit around the earth is elliptical, as also is the orbit of the earth around the sun, so that the distances between the three bodies vary. This variation may cause the tip of the shadow cone to fall short of the earth's surface, in which case an annular eclipse is seen, that is, a ring of the sun's disc remains visible around that of the moon at mid-eclipse.

On September 21, however, the earth passes through the shadow cone of the moon, as the apparent diameter of the moon will be about 1.03 times that of the sun. The circular shadow cone having a diameter ranging from 100 to 130 miles at the surface of the earth, first touches the earth's surface in Somaliland (East Africa), and, owing chiefly to the moon's motion in its orbit, it travels rapidly across the Indian Ocean and Central Australia (tending towards the south) to a point in the Pacific Ocean to the north of New Zealand, at which last contact occurs at



Professor Kerr Grant,
University of Adelaide.

sunset at that place. The time occupied in covering this arc of the earth's surface is about 3½ hours. Within the area traversed by this shadow cone a total eclipse will be visible, having only an instantaneous duration on the northern and southern limits of the area. On the central line, however, the duration will range from about three minutes at the extremities to 5 min. 39 sec. at a point in the Indian Ocean near Christmas Island. Over a much more extensive area, including Arabia, the East Coast of Africa, Southern Asia, Australia, and the islands to the north of Australia, New Zealand, the In-

Dr. C. E. Adams,
New Zealand Government Astronomer.