

used successive photographs of the eclipsed sun as stereoscopic pairs, and demonstrated that the chromosphere and the prominences were solar appendages, and not due to any atmospheric effects on the moon, which occulted these luminous masses in the same manner as it did the solar disc.

- 1861. Sun's rotation periods determined by Carrington from observation of sunspots.
- 1868. Photography of eclipse spectra begun in India. J. Herschell's observation of the helium spectrum in the prominences proved them to be gaseous. Hydrogen spectrum identified in prominences by Lockyer without an eclipse. Helium recorded as an element in the sun by Lockyer. (Identified in terrestrial samples of cleveite by Ramsay, 1895.)
- 1869. Huggins first measured motion in the line of sight (see 1842, 1873, 1892, 1893).
- 1869. Green line of coronium 5303 noted by Young and Harkness, who also saw the reversal of the absorption spectrum to bright lines—the "flash spectrum."
- 1871. Polarisation of coronal light proved it to be partly reflected from solid or liquid particles as suggested by Tennant in 1850 (see 1898).
- 1872. Young noted incomplete nature of chromospheric (flash) spectrum. Proved experimentally by Huggins in 1897 to be due to dissociation of some elements into simpler substances at high temperatures.
- 1873. Vogel, at Zollner's suggestion, first proved the sun's rotation by the Doppler effect.
- 1878. Corona perceptible for some minutes after totality in clear atmosphere of Pike's Peak at an altitude of 14,000 ft. Newcomb and Langley described the extensions of the outer corona. Watson and Swift reported the observation of an inter-mercurial planet.
- 1882. Unknown comet observed near eclipsed sun and photographed by Schuster. Langley invented the bolometer.
- 1883. Fruitless search for the hypothetical inter-mercurial planet "Vulcan." Einstein's theory of relativity has since disposed of the necessity of postulating the existence of such a planet to account for the precession of the perihelion of Mercury (see 1919). Janssen adduced reflected light as the source of the Fraunhofer spectrum in the outer corona.
- 1887. Michelson and Morley obtained negative results when attempting to detect the earth's movement through the ether.
- 1889. Boys invented the radiometer.
- 1891. Spectro-heliographs first erected by Hale and Deslandres.
- 1893. Deslandres first tested the rotation of the corona with the sun.
- 1896. The "flash spectrum" first photographed by Shackleton. Zeeman discovered the magnetic resolution of the Fraunhofer lines predicted by Lorentz.
- 1898. Coronium identified as an element by Masini. Proves the inner corona to be partly gaseous (see 1869, 1871). Campbell secured evidence of the rotation of the corona, but does not consider it conclusive.
- 1905. "The great sunspot" lasted from January 28 to February 12. Einstein formulated the special theory of relativity. Newall failed to confirm rotation of corona.
- 1907. Rambaut observed prominences 531,600 miles in height.
- 1908. Hale discovered solar vortices in hydrogen foculi with spectro-heliograph, and proved the existence of magnetic fields in the sunspots (1876-1893).
- 1910. Total eclipse observed from Mount Lyell, Tasmania. Astronomical expedition to Brunel Island met with adverse weather.
- 1911. Total eclipse over Pacific Ocean observed at Tonga. The shadow cone passed at considerable altitude over Melbourne after daylight, but before sunrise, and most of the stars reappeared. The shadow was also viewed to the southward from Daylesford.
- 1914. The red line 6574 in the spectrum of coronium first discovered by Carrasco.
- 1915. Einstein propounded the general principle of relativity and three tests, one of which is the deflection of a star's light passing close to the sun and visible during a total eclipse.
- 1919. May 29, first satisfactory test for "Einstein effect" by photography of stars near the eclipsed sun. Greenwich observers obtained confirmatory evidence. Variation in ionization of upper atmosphere tested with reference to the strength of radio-telegraphic signals.
- 1922. Present eclipse on September 21. Further test for "Einstein effect." This eclipse is a "saros" return of the eclipse of September 9, 1904, over the Pacific Ocean in the same latitudes.
- 1927. Next total eclipse in Great Britain; duration 0.7 minute. This will be the third since 1340, the others being 1715 and 1724.
- 1976. Next total eclipse in Australia. The third "Saros" return of the present eclipse—1982.

Doings at Wallal.

In a letter dispatched from Wallal by aerial mail to Mr. A. C. Tinsdale, managing director of United Theatres and Films, Waymouth-street, one of the company's official cinematographers (Mr. E. Brandon Cremer), who is with the eclipse party in Western Australia, gives an interesting account of the preparations that have been made there:—

"The camp," he writes, "is composed of 14 tents, two big marquees, and a cook-tent. It is all set out in the form of a small village, and the whole place presents an aspect of fervent activity up till a late hour at night. There are thirty people in our camp, and they are so arranged that there are about three people in a tent 12 ft. by 14 ft., so that there

is plenty of room. The camp wakes at 5.30 every morning, and all begin work until 8 a.m., when breakfast is served, after which they work right through till 1 p.m., when lunch is ready. All siesta until 3 p.m., and work on until 6.30, when work ceases for the day. Dinner is served at 7, and then the scientists do their calculations, and retire about 11 p.m.

"The meals are very good, and wonderfully well served. Members of the expedition are emphatic in their praises of both the cook and the men responsible for the victualling arrangements. The bread is as good as one could wish, and at making the daintier types of dishes the cook is an absolute wonder. There are quite a few natives around here now, but they are a dirty-looking lot, and some appear never to have had a wash in their lives. They are, however, a great help in carting stone, wood, water, &c. The wireless plant is working, and the operator is able to get practically all the important stations in the world. One cannot send anything, but we heard a concert the other evening very distinctly. We photographers are having a little to do in combating the fine dust in the atmosphere, and have to work through the night to get the best results.

"We hope to have everything absolutely correct by the 18th, when rehearsals commence in earnest. The water is quite good both for culinary and photographic purposes. All are well, and on September 7 we had a concert and dinner to celebrate the birthdays of three of the party, which fell on the same day, namely Dr. Moore (Lick Observatory), Professor Ross (Perth), and Mrs. Chant (Canada). All the instruments are more or less ready for the eclipse, and need only final adjustment, and the people who are going to operate them are getting ready for their first rehearsal. They have used about three tons of cement, and a lot of stone for making concrete pillars to support the various instruments. The large camera is somewhat peculiar to look at, and the aborigines wonder why such a large chimney is necessary for such a small tent, as the camera resembles just what they describe. The Einstein cameras are like a small steel bridge, and are very strong and steady, and as there are two sets of them they make quite a showing. Altogether there are about 30 tons weight in cameras in the camp, and they and the tents and marquees make quite a show. The aerial service seems very certain. One of the pilots came down to the camp and did a little passenger flying. He created a great sensation in circling the 40-ft. camera, and 'putting the wind up' the astronomers who were working on it."

Mr. Cremer will leave Wallal for the south by aerial mail on Monday with his films.

MESSAGE FROM CORDILLO DOWNS.

The Lieutenant-Governor (Sir George Murray) on Wednesday received a telegram from Cordillo Downs, dated September 20 and signed by Mr. Daxwell and Professor Kerr Grant as follows:—"Glad to inform you our preparations well advanced. Progress satisfactory. Wireless communication Adelaide now established through arrival Professor Woolnough and party with transmitter. They will assist eclipse observations."

THE WIRELESS STATION.

A temporary wireless station, receiving and transmitting has been installed at Cordillo Downs by the South Australian solar eclipse party. Wireless communication has been established with the Adelaide Radio Station.

PLANS OF WORK AT WALLAL.

WEATHER CONTINUES CLOUDLESS.

Wallal, September 20.

The last rehearsals of the eclipse programme will be held this evening after 6 o'clock, when twilight will give conditions for seeing similar to those during totality. All the rehearsals have passed off successfully and the original schedules have had to be modified only in a few minor particulars. The Lick Observatory expedition has the most extended programme. Dr. Campbell is himself guiding the big twin cameras for the Einstein investigation, and Dr. Trumpler is taking the 15-ft. cameras. Mr. Hoskings and a number of naval men will attend to the changing of the plate holders and the drawing of slides. Two plates will be taken with each 15-ft. camera, the first to be exposed during the eclipse having been previously exposed to the night sky this evening, and left in position; the second plate will be left untouched in the camera after the eclipse, to receive further exposure on Thursday night. The night exposures leave a record on the plates which serves to fix the scale of the actual eclipse negatives. A similar procedure will be fol-

lowed with the 5-ft. pair of cameras, excepting that three plates will be taken with each, the plate exposed at mid-totality being available as a check plate, and also giving a valuable photograph of the solar corona. Five spectrographs (for determining the nature of the solar corona) and three cameras, have been erected on one single axis. This battery of instruments will be operated by Mrs. Campbell, Dr. Moore, and Professor Ross. The lastnamed will also have three special sensitometers for registering photographically the brightness of the corona and of the sky. Dr. Adams and Mrs. Adams will be inside the 40-ft. camera. They will take a series of photographs of the crescent sun just before and just after totality, and another series showing the solar corona. The former set will be used to check the published tables of the moon's motion. In the latter photographs the moon's disc will be more than 4 in. in diameter, and the coronal streamers will probably be recorded, giving a picture about 2 ft. across. Other parts of the Lick programme include visual and photographic investigations of the color of the coronal light in different regions, the visibility of stars, and the occurrence and motion of shadow bands, as the hazy patches of alternate light and shade are called which flit rapidly across the ground just before and just after totality. Lieutenant-Commander Quick will sketch the corona, using a device mounted on a 40-ft. tower to facilitate accurate estimation of the further extent of the coronal streamers.

The Canadian party, consisting of Professor Chant, Mrs. Chant, and Miss Chant, and Dr. Young, are also investigating the Einstein problem. They have, in addition, a polariscope, which enables information to be obtained as to what parts of the corona shine by solar light reflected from solid particles, and what parts are gaseous and possess an intrinsic brightness.

The Indian Kodai-Kanal party, consisting of Mr. and Mrs. Evershed and Mr. Eveson, will, in addition to an examination of the Einstein problem, carry out spectroscopic investigations. One piece of their apparatus is specially designed to photograph what is called the "flash spectrum," and thus to obtain information about the chemical and physical nature of that larger part of the sun's atmosphere which is immediately above its visible surface.

The English party, consisting of Messrs. Hargreaves and Clark Maxwell, have been engaged on measurements of the earth's magnetism at Wallal. During the eclipse they will make photographic investigations of the corona and shadow bands.

The Western Australian party, led by Mr. Rossiter, has made an accurate determination of the latitude and longitude of Wallal, using wireless time signals. Tomorrow its main work will be the photography of the corona. Other investigations will include the nature of the shadow bands, star visibility, and search for any inter-mercurial planet.

The weather continues cloudless, but to-day there has been more wind than usual. This makes the dust problem more acute, and some of the party have decided to postpone developing their plates until they have returned to Broome early next week. Visitors are beginning to arrive here to view to-morrow's phenomenon.

Board of Governor
Public Opinion
Adv. [Signature]