

ECLIPSE AT CORDILLO

A FINE DESCRIPTION.

INTERVIEW WITH PROFESSOR KERR GRANT.

Professor Kerr Grant, of the University of Adelaide, who accompanied the solar eclipse expedition to Cordillo Downs, in an interview on his return home, gave the following interesting account of the work done:

"Thanks to the energetic work of Messrs. Kennedy and Appleby, the advance guard of our expedition, the work of mounting and adjusting the three instruments received from America, through the good offices of Dr. Campbell, was already well advanced at the date of my arrival at Cordillo on September 6. Messrs. Dodwell and Thrum had preceded me by a week. The 40-in. coronagraph of the Lick Observatory, a land mark for miles around, the smaller coronagraph from the same observatory, mounted on an equatorial mounting constructed by the late Mr. Adamson, of Adelaide, and which we called the 'Adamson' instrument, and the 5-ft. telescope from the Allegheny Observatory, lent for the purpose of testing the



Professor Kerr Grant

deflection of rays of light passing near the sun by photographing the stars around the sun during its eclipse, were all in position.

Adjustment of Instruments.

"The excellent definition of the star images on plates taken by Mr. Kennedy with the Einstein instrument showed that its adjustment was nearly perfect, both as regards setting and rate of drawing. This instrument, as also the smaller coronagraph, was equatorially mounted, that is to say, mounted on a shaft which was set exactly parallel to the earth's axis of rotation, and which turned at a rate exactly equal and in the opposite direction to the rate of rotation of the earth. In this way the telescope is kept pointing precisely to the same point of the celestial sphere. The rate of rotation of the shaft or 'polar axis' is controlled by a form of centrifugal governor, mis-called by astronomers, a 'clock,' usually geared directly to the polar axis, but in this particular instrument arranged so as to control the rate of fall of a long wooden arm clamped around the axis. This method of driving proved so satisfactory that we decided to use it also for the smaller coronagraph. In the big coronagraph a different method of compensation for the earth's rotation, due to an American astronomer, Dr. Schaeberle, was employed. The telescope here is fixed, but the photographic plate is made to move across the focal plane of its object glass at a rate and in a direction which keeps the image of a star or other celestial body cast by the lens in exactly the same position on the plate. This rate is also controlled by a 'clock.' On the second night after my arrival we all turned out at 2.30 a.m. to see the image of the moon, which body Mr. Appleby had calculated would be in the field of the big coronagraph at that hour of the morning. Visual observation, confirmed later by a photograph, showed that the plate was in excellent focus, and its rate of motion nearly if not quite exact. Wireless messages and time signals in good strength were being received on the aerial set up by Mr. Kennedy, but the expedition, not having a transmitting set, the sending of messages was not practicable until the arrival of Professor Woolnough's party.

Problem of Exposures.

"Mr. Dodwell and I spent some days in examining carefully the photographs of stars in the eclipse region taken by Mr. Kennedy, with a view of deciding whether it was preferable to give the two long exposures advocated by the American, or the more numerous and shorter exposures counselled by the English astronomers. The long exposure would show fainter and therefore more numerous stars, but there was, as the English experts emphasised, a distinct risk that the stars nearest to the sun, and therefore most valuable for testing Einstein's theory, would be smothered in the image of the corona. To our great satisfaction we found that an exposure of 20 seconds gave stars down to ninth magnitude, about half a dozen of which would be valuable for measurement. An exposure made by Mr. Kennedy half an hour after sunset, when the sky was probably about as bright as it would be during eclipse, also gave the gratifying information that the images of these faint stars showed up quite plainly through the general blackening due to the light of the sky. A further fact of interest was that the star images, which, if perfection of photography were possible, should be mere points 'without parts or magnitude,' increased in size with time of exposure. As this increased size would be adverse to the extreme accuracy of measurement required, we decided in favor of the shorter exposures, and a programme of four plates, the first 20, the second 30, the third 60, and the last 20 seconds. On the first two plates, also, Mr. Dodwell, acting on the advice of the Astronomer Royal, decided to impress during the eclipse comparison fields of stars in a region a few degrees removed from the eclipse region.

VALUABLE HELP.

"Our party of five was greatly strengthened by the arrival about a week before the date of the eclipse of the Brunner-Mond geological exploration expedition, under the leadership of Professor Woolnough (formerly of Adelaide University, and afterwards Professor of Geology at Perth). Professor Woolnough most generously placed himself and his whole party (six in all) entirely at the service of the eclipse expedition, an offer which was gratefully accepted, and which he and the other members of his party immediately proceeded to make good. Professor Woolnough carried a half-horse power spark wireless transmitting set with a generator driven by a Douglas petrol engine. Lieutenant Bowen, his wireless expert, immediately set to work in co-operation with Mr. E. A. Thrum to get this set into working order. Overcoming various difficulties, they succeeded in doing this in about three days, and at the second trial had the satisfaction of getting a reply from the Adelaide wireless station. Thenceforth until after the eclipse Cordillo was in wireless communication with Adelaide. In view of the opinion previously expressed by many experts, that there was practically no hope of reaching Adelaide from Cordillo with a transmitting set of this power and type, the success attained by Messrs. Bowen and Thrum is particularly gratifying, and proves that with a modern continuous-wave set, even of much smaller power, radio-communication from all parts of the interior with Adelaide is readily practicable. Undoubtedly in the near future radio-telephony will remove the difficulty of communication with the sparsely-settled interior of the continent.

Completing the Equipment.

"The arrival of Messrs. Barr Smith, Ives, and Adamson gave a further welcome addition to our strength. These gentlemen had picked up on their journey various items of our observing equipment, including a wireless set for long-wave reception, which Mr. Thrum had put together, and a small spectroscope which I had made, and with the co-operation of Mr. Thrum used at the University for observing the spectrum of the light of the night-sky. This spectroscope had a very fast lens (cinema lens, 2.3 aperture), and I was hopeful that, by its use we might get some new lines in the coronal spectrum. Professor Woolnough kindly offered to take in hand setting it up, adjusting it, and making the exposures during the eclipse. In addition to this he carried out the work of converting the driving arrangement of the Adamson instrument to one similar to that employed on the Einstein instrument, and succeeded thus in securing an almost perfect drive for this instrument. I must not omit to say how much we owe also to the mechanical skill of Mr. Kirby Dixon, of the Brunner-Mond expedition. Without his services it is doubtful whether the two additional plate-holders, which are required for the Einstein camera, could have been made, and we owe many other ingenious accessories to his ingenuity and tireless industry.

The Programme Rehearsed.

"During the last few days each party began to rehearse its programme. Mr. Barr Smith undertook the highly responsible duty (on which, in fact, the whole programme depended) of calling time

out of totality. Our Einstein party consisted of Mr. Dodwell, guiding, exposing, and changing from the eclipse to the comparison field, myself, assisted by Mr. Kirby Dixon and Mr. Murray, to change the plate-holders (ten seconds was allowed to close the dark slide, loosen the holding screws, remove one plate holder, insert the next, tighten the screws and draw the slide); and Mrs. Murray to show a torchlight if required. The dark tent of the big coronagraph was occupied by Mr. Appleby and Mr. Kindler, of the Education Department, whom the Director (Mr. McCoy) kindly permitted to come up from Innamincka to assist in the observations. At the Adamson instrument were Mr. Adamson, changing plates; Professor Woolnough, managing the spectroscope, which was mounted on the same axis, and two other members of Professor Woolnough's party; while Mr. Ives kept the record of the exposures. Mr. Kennedy, for several days prior to the eclipse, was engaged in the tedious work of carrying out magnetic observations in accordance with the Carnegie Institution's programme. His observation tent was situated nearly a quarter of a mile to the east of the main camp. Messrs. Thrum and Bowen were to record the strength of wireless signals throughout the eclipse, and several other visitors and employes undertook to look out for the 'shadow bands.' Dr. McGilivray, with Messrs. Heywood and Riddell, of Broken Hill, arrived a day or two before the eclipse and also gave help. Dr. McGilivray, undertaking to sketch the corona, and Mr. Riddell checking time with Mr. Barr Smith.

Awaiting Totality.

"For some days before the eclipse weather prospects were anxiously scrutinised and discussed, and we were greatly relieved when a northerly blow, with a promise of fair weather in its wake, took place on Monday and Tuesday. On the morning of the 21st the sky was perfectly clear, but a strong south-east wind got up about 10 o'clock, and caused great anxiety. Fortunately it was of short duration, and by 1 p.m. conditions were as perfect as we could wish. First contact of sun and moon duly occurred within a few seconds of the time calculated by Mr. Merfeld, of Melbourne Observatory, and the gradual progress of the eclipse was watched with interest through smoked glass by everybody except the Adamson party, who were busy taking photographs. A quarter of an hour before totality all hands took their stations. The position of the image of the crescent sun was checked in the Einstein camera, the first plate-holder inserted, and the final moment awaited. Mr. Appleby, in the dark tent, had the image of the waning crescent continually on the lid of the box containing the plate, and could thus judge of the interval yet to elapse before the total eclipse. In accordance with our programme he called successively, 'three minutes to go, two minutes to go, &c.' At 'half a minute' we heard a stroke on the shearer's bell, which announced that Mr. Polkinghorne had detected the shadow-bands. Waiting the signal, 'Go,' at which I had to draw the slide I missed seeing these, though Mr. Dixon, beside me, remarked, 'Look at those curious shadows.' Instantly on seeing them Mr. Roberts, of Lyndhurst, who was outside, fired a gun as a signal to Mr. Kennedy, who was to watch for and record the time taken by the bands to arrive at his camp.

Exciting Moments.

"Then, 'Go,' was shouted by Mr. Appleby, repeated instantly by Mr. Barr-Smith, who took up the count from that instant, and we all got to work. I drew the slide. Mr. Dodwell, five seconds later, dropped the black curtain in front of the lens, and our first exposure proceeded. Meanwhile, our party had a splendid view of the beautiful solar corona surrounding the dead black disc of the moon, with two projections above and a single one below, and a curious circular black rift extending outwards from the upper quadrants of the lunar disc on either side. I took this at first for an illusion due to an after-image of the vanishing bright crescent of the sun, but it persisted throughout the total phase, and was seen by others. The photographs should settle the question of its reality. Our programme in the Einstein tent went forward without a hitch. Five seconds before totality, Mr. Dodwell called out, 'Look at the chromosphere.' There, emerging at the rear of the advancing black disc, was the ring of lurid flame with large plume-like projections or 'prominences.' Fearful that the bright edge of the sun would appear and spoil our last plate, I called to Dodwell, 'Close the shutter,' quite needless, for he had pulled his shutter across the lens in good time, and our job was finished.

"The other parties had been equally successful. Messrs. Appleby and Kindler did splendid work in getting no fewer than fourteen photographs during the four minutes; thus fulfilling as nearly as possible Dr. Campbell's desire to have two parallel sets of photos—at Wallal and at Cordillo—taken with similar instruments. The Adamson party had secured two long exposure plates of the corona, with a view of getting the structural detail of its outer parts. Whether anything will appear on our spectroscopic plates is doubtful. I had supposed that the image of the

chromosphere as a corona, thrown by a 5-ft. lens on the slit of the spectroscope would be sufficiently bright to be visible during totality. This was, unfortunately, not so, and Professor Woolnough was therefore, obliged to make a guess at the right adjustment.

The Wireless Signals.

Messrs. Thrum and Bowen, sitting at the door of their wireless tent with the telephones on their ears, listened to the Y's sent out continuously from the Sydney station. As totality approached the strength of these signals died away, until they became inaudible, recovering again as the light of the sun came back to the full strength. Mr. Thrum also made the interesting observation that the shadow bands, after totality, appear to travel westwards, whereas the set seen before totality went in an easterly direction, with the eclipse shadow itself. The value of the results obtained cannot, of course, be stated until the photographic plates taken have been developed and examined, but there is good reason for hoping that these will prove satisfactory and form a useful contribution to the data on eclipses."

BACK FROM WALLAL.

2,700 MILES IN SIX DAYS.

As the steamer Goryon pulled alongside the wharf at Fremantle on Thursday last the passengers noticed an aeroplane circling overhead. The pilot was Major Brearley, of Airways, Limited, and two hours later he handed to one of the passengers a parcel. It contained a pair of pyjamas, and the recipient was Mr. E. Brandon Cremer, one of the United Theatres and Films, Limited, official cinematographers, who returned to Adelaide on Sunday night from Wallal with the films taken of the eclipse, after covering 2,700 miles in six days.

"There is a story connected with that pair of pyjamas," he said. "When my company approached Airways, Limited, to bring me from Wallal with the films taken of the eclipse it was found that there were passengers who had been booked up for weeks ahead. The wires were set going, however, and after an anxious time it was decided that they could manage to get me through to Carnarvon, where I could catch the steamer for Fremantle. Major Brearley was in charge of the aeroplane by which I travelled, and when it came to a question of bringing luggage he said it could not be done. 'You can bring the film and a pair of pyjamas, and that is all I can allow you,' he said. I did. I carried that pyjamas to Carnarvon, and then, in the hurry of getting away, forgot them. On the platform at Perth Major Brearley handed them to me again. He had brought them all the way, and was just in time to catch the train.

"It is a wonderful trip, that run by air from Wallal. We left on the Monday morning, and, after circling the camp, headed straight across to Port Headland, being at one time 50 miles out to sea. Down below you see the great brown and ochre colored land, with its isolated station buildings scattered here and there. Then come the bright green of the mangrove swamps, interlaced with the whitish blue of the rivers and creeks. Against the edge of the green is the golden strip of the beaches, and against this again the deep blue of the ocean. Our trip was not too pleasant for the first stage, as we came along on the tail of the gale which upset all the calculations of the party back at Wallal. After that, however, we had a good run, and made excellent time. 'You have already had most of the news through about the success of the eclipse party from a scientific point of view, and there is little I can add. We all had an anxious time while it was on, but the rehearsals had been through, and there were no hitches except on the part of the aboriginals. As soon as the first contact occurred, with the exception of three, they all hurried for the bush, and we saw no more of them until they were sure that it was all over. Then they came sneaking back. Those who stayed were shown the phenomenon through a piece of stained glass, and one of them remarked, 'My word, big feller piece gone.'

"An unfortunate, or amusing thing occurred last Sunday, according to how you view it. Orders were given that camp should be struck on the Sunday, and accordingly everything, with the exception of two tents for the ladies, was stripped and sent down to the beach where we all slept that night. In the morning a violent gale was blowing, and it was impossible to get anything away. One of the whaleboats was capsized, and everybody was stranded on the beach with only a little tinned food left; and no cookhouse to warm it in. The camp was three miles away from the beach, and they had an unpleasant time of it.

"I am starting work on the developing of the films to-morrow, as the members of the party are anxious to see them before they go back. That of the eclipse will show somewhere in the neighborhood of 1,000 pictures from the first contact until the fourth, and is expected to be a valuable aid to science. This is the greatest number of pictures that has ever been taken of an eclipse, and it is hoped that the movement of the corona can be studied closely. Apart from that, there are other pictures showing life at the camp and the work of preparing the instruments. I expect to have it ready in about a fortnight, when it will be offered to all the State educational departments for showing to the children. In addition to this some 200 copies have been ordered by various scientific bodies throughout the world, and it should prove a great help towards advancing Australia, especially in scientific circles."