Naked-Eye Observations of an Eclipse of the Sun.

By ANNIE S. D. MAUNDER.

NO observer of the partial phase of a total solar eclipse should look at the sun with the naked eye. During this phase some people advise the use of coloured gelatine spectacles, smoked glass, or darkened photographic film; others advocate a graduated screen, using always the densest possible part of it. A very serious attitude is taken in the *Lancet* of April 30, where two ophthalmic surgeons urge that the public must be made to understand that neither smoked glass nor fogged photographic film are safe screens even when well prepared, seeing that they do not absorb the irritant ultra-violet rays, and to avoid the risk of 'eclipse blindness' use must be made of a photographic film which (after fogging so as to obtain the necessary density) has been treated by a special process which excludes wave-lengths shorter than 4000 Å.U.

My own precautionary method is at once safer, cheaper, and more effective. It is this: Do not look at the sun at all—either with the eyes screened or unscreened—until totality is just about to begin. During the partial phase there is nothing on the sun of interest that cannot be seen better by looking on the earth. In other words, project in all cases the sun's image on a screen—white card, ground glass, pavement, or wall—whether the projection be through a telescope, or the 'pinholes' made in a cardboard, or between the leaves of a tree. (Projection, on ground glass or white cardboard, through a telescope, is of course the best way for timing the four contacts of sun and moon.) The little 'decrecent' or 'crescent' suns upon a wall or pavement are very pretty to watch and can easily be photographed. Nor is it the image only of the sun itself that becomes bow-shaped, but also the shadows cast by it. I first noticed this in the very large partial eclipse of 1912, seen in Paris, as an eclipse something between total and annular, when the sun was high in the heavens at noon, and standing on the flat roof of a house in Greenwich, I looked down on my shadow far below on the pavement. This showed my ears pointed like the traditional faun's; and, more curious still, when I stretched out my open hand, all my fingertips were drawn out and bent like a bird's claw.

By the time that the sun has become a narrow bow in outline, and there remain but a few minutes, perhaps three or four, before the actual beginning of totality, the shadow-bands should begin to dance in streaks or wavy lines. I have heard these compared to many things, but I have never had the

good fortune to see them myself; to the shadows of the ripples on the surface of the clear water dancing on the shingly beach below; to the shadows cast on the wall of a room from rippling sunlit waters outside. In the words of Mr. C. L. Brook (at the 1900 eclipse), "ripples raised on water by a bright breeze represent best what may be termed the structure of the shadows; they all move in the same direction, each ripple element is linear in character but retains its individuality only for a moment, appears to dissolve away and others take its place." In the Australian eclipse of 1922, some observers saw a flickering shadow hovering over distant trees eleven minutes before totality; later, on the ground, round their feet: "they flitted under the trees as the shadow of a bird might when flying above." Immediately after totality, the whole light was crimson for about ten seconds, and *red* and *black* shadow-bands raced over the ground. The bands were seen by chromospheric, not by sunlight. From the scientific point of view, the ideal occasion for their observation was in the American eclipse of January 1925, when Nature itself provided a white carpet for them to dance upon. It has been thought that they were due to currents in our upper atmosphere and that we could learn from them something about this; but the Americans observed them too closely and found that they were wind swirls—little 'devils' they are called in India—close to the ground, and in one place were seen to be chasing one another in all directions round a tree.

Whether the onrush of the moon's shadow can be seen at the coming eclipse will depend on whether the weather is clear or hazy. At the American eclipse it was looked for, but was undefined because of the haze. Major Hepburn says that this is the most impressive feature of the spectacle: "the onrush from a certain direction of rapidly spreading and engulfing darkness." But those who have work to do during totality have to forgo this experience.

The eclipse of June 29 is a young one; it is total—and not very much total at that—for the first time; when it is a Saros older it will be better. As a consequence, the chromospheric ring will probably be visible throughout the whole period that the sun's disc is covered. The form and size of the corona will depend on the actual state of activity of the sun at the moment. If there are many and great sunspots and prominences, and if these are near the sun's edge, then we may expect a complex

inner corona, which, however, will only show to the naked eye as a bright silver ring surrounding the narrow pink circle of the chromosphere, with long coronal streamers extending in all directions; if there are no spots and insignificant prominences on the sun, then the coronal wings will lie folded along the sun's equator. Prominences, of course, will be visible to the naked eye only if large enough; keen sight could detect a prominence of 40,000 miles height; one of 200,000 miles should be easily visible. The corona will be ivory or white in colour; the chromosphere will be rosy; prominences will probably be red, but they may be white.

We would wish for June 29, that the weather on the sun should be stormy with many eruptions; that—for naked-eye observers—there should be deep lunar valleys near the points of second and third contacts; and that great red prominences should show up where these lunar valleys are.

In the American eclipse of 1925, New York City had a very beautiful aspect of the eclipse, which there was of short totality. The eclipsed sun showed as a faint circle of light with an intensely brilliant place at one spot, the rays from which spread out and gave the impression of a ring with a big diamond inserted in the usual way. There was a depression in the moon's edge which grazed the edge of the sun for some time, as seen from New York, which lay on the edge of the shadow track, just as Liverpool lies (probably) on the edge of the shadow track on June 29 next. In one of the Russian chronicles there is a description of the eclipse of May 1, 1185: "In the evening there was an eclipse of the sun. It was getting very gloomy and stars were seen, and in the men's eyes was a green light. The sun became similar in appearance to the moon, and from its horns came out somewhat like live embers"; which seems to point to something like the 'diamond ring,' perhaps a prominence as well as sunlight.

I have myself only once seen the eclipsed sun with the naked eye, and then it seemed small, much smaller than the full sun and moon to which I have been accustomed. But this was in India, with the sun high in the heavens. Mr. H. B. Adames saw the beginning of the eclipse of 1905 as the sun rose over Lake Winnipeg, and to him the entire body of the moon, which suddenly appeared with a blood-red prominence on either side, was a "huge black ball immensely exaggerated."

The effect of the rapidly diminishing sunlight on land and sky is weird and uncanny; all life and warmth fade out of the landscape; the flowers look withered, the grass and trees lose all trace of their living green and become of a dull lead colour; even the very faces of the observers become livid. If the sky is blue, it changes to a deep funereal purple. If there are small clouds near the sun, the iridescent colours, which are always there but not always easily seen, stand out vividly as in a spectrum. Round the horizon—which is near or beyond the shadow's edge—there is a glow of an angry gold, a sulphur light, not tinged with red. These are sunset effects, perhaps, which become visible when the daylight is cut off, but they may owe something also, as Mr. C. T. Whitmell suggested, to the red chromospheric light. If clear, it will be well to glance at the shadows cast by the corona; in 1922, Miss Miriam Chisholm found that these, though present, were undefined.

In my opinion, all naked-eye observers who are artists should make the painting of the colour effects on land, sky, and sea their chief study at this eclipse. It is not, of course, possible to do this work actually in the short totality, but the outline should be drawn before the eclipse, the colours noted during the total phase, and the painting finished afterwards while the tints are still fresh in the memory. Like meteorologists, artists get their results, whether the eclipse is clear or cloudy.

Eclipse Photography.

By C. P. BUTLER.

ALTHOUGH the total solar eclipse on Wednesday, June 29, will be one of short duration—about 23 seconds total obscuration in England, and 30 to 40 seconds in Norway—the improvements in sensitivity of photographic materials and design of optical equipment warrant the attempt to obtain photographic records of various stages of the phenomenon. In order to give information wanted by observers having diversity of equipment, we may briefly summarise the various means with which observations may usefully be undertaken.

Ordinary Cameras.—These may range from the modest hand-camera to the largest field or studio apparatus, preferably fitted with some controllable exposing apparatus other than merely the lens cap. These may all give interesting pictures, but the scale of the result will be strictly proportional to the focal length of the lens employed. The diameters of the sun and moon are about half a degree of arc on the sky, so it is a simple matter to calculate what the actual linear diameter of the image of the eclipsed sun will be with any given