

novel methods, the pace of inquiry has been quickened all along the line. Particulars are accumulated faster than they can be assorted and arranged. Time has virtually expanded as if for the purpose of gratifying curiosity which becomes keener, as its sublime objects loom more distinctly above the horizon of thought. Ten years now count for a century of the old plodding advance and we can now reasonably look forward to a day when the genius of astronomers will render the future as distinct as the present.

THE OBSERVATION OF SUN-SPOT

(A Note read on the 24th March 1920.)

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The solar disc is much too bright to be looked at with the unprotected eye, hence to a casual observer the sun appears to be uniformly bright. With a fairly high powerful telescope fitted with a special eye-piece however, this aspect is changed. The solar surface then appears granulated and we find certain small areas consisting of a dusky part (*umbra*) surrounding a dark central nucleus (*penumbra*). These are the typical sun spots. There are other sun spots as well, which appear to be very minute and consist of only the umbral part.

If we watch a particular sun spot for several days in succession, we find that it has changed its position with respect to the edges of the solar disc. This is due to the motion of the sun which rotates about its axis so as to make a complete revolution in about 28 days. Hence after the appearance of a sun spot for the first time on the eastern limb of the sun, it disappears from view in about 14 days on the western limb and may again make its appearance after

another fortnight. Besides this motion, the sun spots have a motion of their own—proper motion as it is called,—but that is very slow and up to the present time it remains a very complex question for the astronomers to answer.

A remarkable thing about the sun spots is that they very seldom occur at a distance of more than 40° on either side of the solar equator. Within this belt 80° wide, the distribution of spots is very irregular. They occur mainly in two zones on either side of the equator between 10° and 30° .

Another remarkable thing about them is that we do not see the same number of sun spots every month, much less in every year. There are periods of sun spots maximum and sun spots minimum, the period being about 11 years, although opinions vary to a very great extent on this point. The present time is rather unfortunate for sun spot observation as we are drawing near the time of sun spot minimum. We expect that in 1924, we shall find the sun's surface free from sun spots and after that they will reappear in higher latitudes, say 30° to 40° North and South of the sun's equator.

Our sun spot observation began in the middle of the last month and it was on the 26th February last that we succeeded in getting the images of sunspots projected on a specially constructed board, the most suitable time of observation being an hour within sunrise or sunset. At first we saw a fairly large sun spot, the umbral and penumbral portions of which were distinctly visible. Besides this, there was a cluster of sunspots—very small in dimensions—and they consisted of only umbral regions, the peculiarity of these sunspots is that all of them were found situated near the sun's equatorial region. We kept on watching them day by day and they slowly glided along the solar disc., until, about a week ago, we missed the larger one. The cluster of sunspots still remains in the field, and one might see them with advantage between 6-30 and 7-30 A. M. with a fairly high powerful telescope, lying about in solar equator, a little to the south, occupying almost an edge of the sun. Meanwhile we may expect the advent of new sun spots and the return of

the one we have lost after a few days, if in the meantime, it does not split into two or more fragments, as sun spots are apt to do not unfrequently.

I shall now describe how the images of sun spots can be got on the projection board stated above. The Nautical Almanac gives the heliographical latitude of the centre of the sun's disc for every day. Charts¹ of solar discs may thus be made with different latitudes varying from -7° to $+7^{\circ}$ as it never exceeds $7^{\circ}.15$. The nautical almanac also gives us the position angle of the north point of the solar axis. This being found out on the chart, positions 90° distant on either side of that point gives us the east and the west point of the sun. The projection board is attached to the eye-piece and of an equatorial telescope at a certain distance away from us. The chart is then placed on the board with the cardinal points N, E. and S. W. on the chart corresponding to these points on the projected image and adjusted till a spot is obtained to run across the line joining the east and west points of the image of the sun, while the telescope is moved up and down *i.e.* East and West. The chart is then said to be strictly oriented and may be pinned to the board for sketching the sun spots and finding out their dimensions with regard to the solar image thus obtained.

Attempts are being made to study the sun spots from astrophysical standpoint and in a future communication I hope to place before the Society, the results of my observation in this direction.

Before concluding I must express my indebtedness to Dr. D. N. Mallik for the very keen interest he has all along been taking in sun spots and the constant guidance I am receiving at his hands.
