

short periods is, in fact, due to this near approach to equality in the amount of total action in periods of different lengths. There is, however, a remarkable relation indicated by Prof. Wolf's results which, though not noticed by him, is, perhaps, hardly less important and instructive than the law which he has announced.

If we denote by  $R$  the ratio of the intervals from minimum to maximum, and from maximum to minimum, we find that

Five periods, having a mean value of 12·36 years, give	$R = \frac{5\cdot12}{7\cdot24} = 0\cdot707$
Five periods, mean value 9·98 years ... ..	$R = \frac{4\cdot54}{5\cdot44} = 0\cdot834$
Five periods, having a mean maximum activity of 96·12, give ... ..	$R = \frac{3\cdot78}{7\cdot10} = 0\cdot532$
Five periods, having a mean maximum activity of 62·44, give ... ..	$R = \frac{5\cdot88}{5\cdot58} = 1\cdot053$
Five periods, having a mean total amount of action = 544·38, give ... ..	$R = \frac{3\cdot78}{7\cdot10} = 0\cdot532$
Four periods, having a mean total amount of action = 319·12, give ... ..	$R = \frac{5\cdot97}{5\cdot55} = 1\cdot075$
The mean value of $R$ from all the periods in Prof. Wolf's list is ... ..	$R = \frac{4\cdot83}{6\cdot34} = 0\cdot761$

It appears, therefore, that the value of  $R$  is least in long periods and periods of great activity, and greatest in short periods and periods of diminished activity. Variations in the amount or in the maximum intensity of action, have, however, greater influence than changes in the length of the period.

As most of the variable stars have very unequal rates of increase and decrease of brightness, and as the ratio of these rates is also found to be affected by changes in the length of the period and in the range of variation of brightness, Prof. Wolf's results for the Sun give additional importance to the view taken by some astronomers, that the solar spots and the phenomena of the variable stars are produced by similar agencies.

*Manchester, Feb. 20, 1861.*

*On the Persistency during three days of two light Patches on a Solar Spot. By W. R. Birt, Esq.*

On the 9th of July, 1860, between 3<sup>h</sup> 30<sup>m</sup> and 5<sup>h</sup> G.M.T., I observed and figured an interesting solar spot on the southern

hemisphere of the sun, fig. 1. It consisted of a somewhat large nucleus surrounded by a penumbra, the northern part of which was separated from the main body by a bridge of light, and several small spots were seen as outlines, mostly in the direction of the longest diameter of the penumbra.

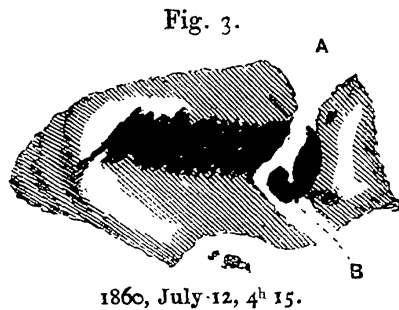
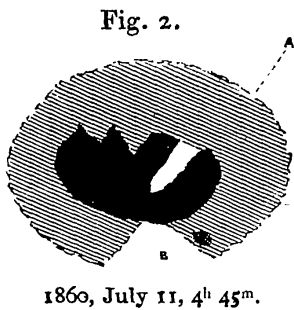
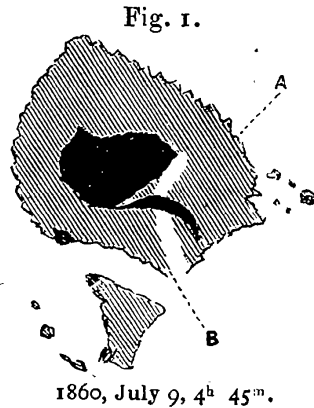
The most interesting features characterising this spot were:—

1°. A dark tongue or spur of a curved form, the convexity being towards the nucleus, it was *only just* attached to the main body of the nucleus and *apparently* a portion of it.

2°. Bordering the eastern part of the nucleus, and partially separating the dark tongue or spur, a bright patch of light was seen, A, fig. 1.

3°. Another bright patch of light was noticed north of the spur, and projecting from the curved portion at a considerable angle, B, fig. 1.

On the 11th of July, between 4<sup>h</sup> 30<sup>m</sup> and 5<sup>h</sup> G.M.T., I again figured the same spot, fig. 2; every portion had undergone a very considerable change, the outlines of both nucleus and penumbra having altered materially, the surface of the



penumbra appeared to be exceedingly mottled from numerous small light patches scattered over it, the spur seen on the 9th was recognised as well as the two light patches, A and B, fig. 2, the relative positions being unchanged both as regarded direction and locality in the spot.

About 24 hours later, viz. on July 12th, from 3<sup>h</sup> 30<sup>m</sup> to 5<sup>h</sup> G.M.T., all the features of the spot, except the spur and the two light patches, had undergone very remarkable changes, the nucleus was much elongated, and the spur entirely separated, the penumbra exhibited appearances of having been subject to considerable agitation (see fig. 3) at the western extremity of the nucleus, a lighter portion surrounding it crossed by a narrow and dark bridge appeared to have drawn the material of the penumbra westwardly, while the two light patches seen on

the 9th and 11th maintained their positions (A and B, fig. 3), the outline of the penumbra was very irregular, and towards the eastern extremity was broken into several angles, a portion of the penumbra itself being separated from the main body of the spot by the two persistent light patches.

It is not a little remarkable, and a matter that deserves close attention, that while every other portion of the spot underwent considerable change, the two patches of light with the spur maintained at least the same relative positions with regard to each other; observed at first in the eastern portion of the spot, while evidence was afforded of increasingly energetic action by which the nucleus was elongated *westwards* and the penumbra driven in the same direction, the patches of light preserved nearly the same form and inclination to each other accompanied by the spur (a part of the nucleus), which although it did not alter its relative position with regard to them, yet underwent modifications in form which did not appear to affect them. It would seem that from the neighbourhood of the two light patches a force of sufficient energy to extend the spot westwardly was in active operation, while eastwardly the action was confined to modifying the penumbra and altering the form of the spur.

*On the Apparent Rotation of a Solar Spot.*

By W. R. Birt, Esq.

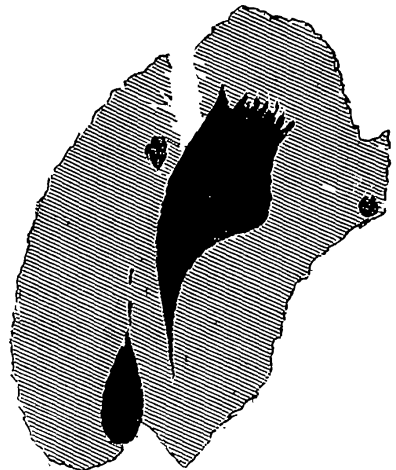
On the 29th of October, 1860, about 23<sup>h</sup> G.M.T., I carefully observed and figured a solar spot, see sketch, fig. 1. The

Fig. 1.



1860, Oct. 29, 23<sup>h</sup> 0<sup>m</sup>.

Fig. 2.



1860, Oct. 31, 22<sup>h</sup> 30<sup>m</sup>.

next opportunity I had of viewing this spot was on October 31, about 22<sup>h</sup> 15<sup>m</sup>, when I again made a sketch of it, see fig. 2.