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.

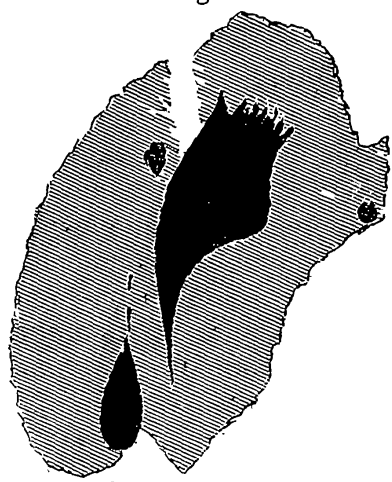
By W. R. Birt, Esq.

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

Fig. 1.

1860, Oct. 29, 23^h 0^m.

Fig. 2.



1860, Oct. 31, 22^h 30^m

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

During the 47 hours and a quarter that elapsed between the two a very considerable change had taken place, and some indications of rotation were afforded.

The spot on the 29th presented a feature by no means rare, viz. the presence of a principal, and also of a secondary nucleus, the breadth by estimation* of the southern or broadest part of the principal nucleus was about 15″, the longest diameter being directed towards the north-west, the nucleus ending in a fine point, the eastern side of the nucleus being convex while the western was concave. The secondary nucleus was westward of the principal, irregular in its form, the northern part being curved, the parallelism of the two nuclei was distinctly apparent.

The outline of the penumbra presented the ordinary irregular character, the curved portion of the secondary nucleus and the outline of the penumbra were in contact.

On the 31st, a remarkable change was observed in the two nuclei, the southern portion of the principal nucleus was still the broadest, and occupied much the same position, but the two sides were altered exceedingly, the western side was smoothly convex; and the eastern smoothly concave with a marked protuberance. As on the former occasion the nucleus terminated towards the north in a fine point.

The secondary nucleus had changed its form and position considerably, it appeared as if all its material had progressed so as to have met with such a resistance as to have produced a smooth curvilinear outline, broadest at the front and gradually tapering to a point, the figure strongly suggests the idea of semi-fluidity, the same contact of the penumbral outline with the front of the secondary nucleus observed on the 29th was also seen on the 31st, but in such a position as strongly to suggest a rotation of the entire spot, and also that the secondary nucleus in its motion northward had turned the point of the principal nucleus, the centre of motion being in the neighbourhood of the broadest portion of the principal nucleus.

The longest diameter of the spot was much in the same direction as on the 29th, it however appeared more marked on the 31st, as the spot was foreshortened by its approach to the limb, the parallelism of the two nuclei being very apparent, but not in the direction of the longest diameter of the spot.

On November $1^d\ 21^h\ 15^m$, G.M.T., I obtained another sketch, fig. 3, of this spot. As it approached the limb, it not only apparently, but I apprehend really, increased in magnitude, the evidence of rotation being still very marked around the southern part of the principal nucleus. It would appear that this part of the nucleus had become broader, the point observed on the two former occasions was blunted and a

* This estimation was obtained by means of an etched glass micrometer, constructed for me by L. Casella, Esq., the value of each division being a little more than 1′.

somewhat thick dark line extended from the principal towards the secondary nucleus, which had evidently increased considerably in size since Oct. 29th. As on the two former occasions the parallelism of the two nuclei was maintained, the further indication of rotation consisting in the advance of the secondary nucleus in an eastward direction, the whole body of the spot being apparently carried round with it.

On the 31st of October a streak of light divided the penumbra in the neighbourhood of the south-western part of the principal nucleus, this had so considerably increased by November $1^d\ 21^h\ 15^m$ as to leave a portion of the principal nucleus without any penumbral appendage, the contact of the secondary nucleus with the edge of the penumbra being still maintained.

Nov. $2^d\ 21^h\ 45^m$. Nearly the same features were presented accompanied with an evident arrestation of the rotatory movement, and a very slight divergence from parallelism in the two nuclei. Sketch, fig. 4, exhibits the appearance of the spot at

Fig. 3.

1860, Nov. 1, $21^h\ 30^m$.

Fig. 4.

1860, Nov. 2, $21^h\ 30^m$.

this epoch, and shows the great change that had supervened in the positions and appearances of the nuclei during the 95 hours the spot had been under observation; this sketch is very instructive, and indicates, I apprehend unmistakeably, that the apparent rotation is due to the motion of the secondary nucleus, sketches 2 and 3, exhibiting successive steps in the divergence of the nuclei, a fact spoken of repeatedly by Mr. Carrington. Shortly after the completion of sketch 4 the long thin line nearly connecting the principal with the secondary nucleus was observed breaking up into two or three small

spots; and during the progress of the sketch the penumbra underwent change, several lucid portions within its boundary were noticed near the nuclei, and generally much more energetic action was manifested upon the cessation of the apparent rotatory motion than while it was in progress; there also appeared to be indications of internal curvilinear motion.

An Auxiliary Table for the Easy Calculation of Log. sin. and Log. tan. of Small Arcs. By S. M. Drach, Esq.

The table which I herewith offer to the Royal Astronomical Society has been found by me to be very useful, especially at the beginning of the quadrant, obviating the necessity of interpolations in the ordinary "small arc log. sin., &c." table, and could be appended in detached portions to seven fig. logs. of numbers. Thus to find, by means of it, log. sin. and log. tan. of $7'\ 34''{\cdot}82$.

$$7'\ 34''{\cdot}82 = 454''{\cdot}82$$

Log $454''{\cdot}82$	$= 2{\cdot}6578396$		$2{\cdot}6578396$
Tab. $8'$ sin.	$= 4{\cdot}6855745$	Tab. $8'$ tan.	$4{\cdot}6855756$
log. sin $7'\ 34''{\cdot}82$	$7{\cdot}3434141$	log. tan.	$7{\cdot}3434152$

But for this purpose the logs. of numbers must be extended to 10800.

A great advantage would result from prefixing a column to the No. in the logs. of numbers indicating the deg. and min. of the No., considered as denoting a number of seconds.*

With such a table the proportional logarithms of nautical tables might be dispensed with, the constant for 3^h or 3° being 10800 or 4·0334238. Thus, suppose the Greenwich three hourly distances of the Moon from a star, according to the *Nautical Almanac*, be $1^\circ\ 12'\ 21''$, and the observer finds his corrected distance to be $1^\circ\ 4'\ 12''$, the interval for Greenwich time would be thus computed:—

C. log 10800 (3^h)	$= 4{\cdot}0334238$
Subtract log 4341 ($1^\circ\ 12'\ 21''$)	$3{\cdot}6375898$
	$0{\cdot}3958340$
Add log 3852 ($1^\circ\ 4'\ 12''$)	$3{\cdot}5846863$
$2^h\ 39^m\ 21^s{\cdot}4 = 9561''{\cdot}4 =$ log.	$3{\cdot}9805203$

* This is done at the foot of the page in Bremiker's Tables, Berlin, 1852.—Ed.