The Astronomical Register.

No. 58. OCTOBER. 1867.

THE PLANET JUPITER WITHOUT HIS SATELLITES.

SEVERAL of the numerous letters we have received on this subject are accompanied by drawings more or less carefully executed of the appearance of the planet on the evening of the 21st August. From these we have prepared a sketch of the phenomenon as seen in a moderate-sized telescope, a wood engraving of which we present to our readers with this number of the *Register*.

TO THE EDITOR OF THE ASTRONOMICAL REGISTER.

Sir,—The ingress of the third satellite of Jupiter, and also of the shadows of the third and fourth satellites, could not be observed here last evening because of clouds and the low altitude of the planet.

The first observation obtained was that of the eclipse of the second satellite, and as from that time until the egress of the fourth satellite this morning, the sky was cloudless, the remaining observations were made satisfactorily.

The third and fourth satellites entered on the disc very bright and distinct, but as they got clear away from the limb they gradually faded, until they could not be seen; a little further on, they reappeared as dark spots, deepening in shade until they were black, and on comparing them with their shadows, they seemed smaller, but not quite so black. The fourth could not be distinguished in size or colour from the shadow of No. 1. The third was not quite so dark. They remained black until they arrived at about the same distance from the other limb, when they disappeared the second time, and again reappeared bright before they got quite to the limb.

The first satellite was seen on the limb, and just inside of it, very bright indeed, but it faded as it got on to the disc away from the limb, and after a time could not be distinguished from the planet: it continued so until it arrived near the other limb, when it reappeared bright.

There was a sort of border, or halo, round the shadows of the third and fourth satellites, but none could be certainly seen round that of No. 1. As the shadows passed off the planet, they gave a decided impression of the roundness of the planet near the limb; but this appearance was not noticed at the egress of the satellites themselves.

The following measures were taken at 10h. 30m. p.m.: Lens, 6-inch; power, 220:—

Preceding limb to shadow of No.	3	.		12·53
,, ,, ,,	3	.		17·81
,, ,, ,,	4	.		25·54
,, ,, ,,	4	.		36·84
,, ,, ,,	1	.		36·84

Diameter of disc = 49″·5.

I remain, Sir, yours respectfully,

Waterloo, near Liverpool: JOHN JOYNSON.
August 22, 1867.

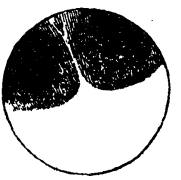
JUPITER WITHOUT A VISIBLE SATELLITE.

TO THE EDITOR OF THE ASTRONOMICAL REGISTER.

Sir,—The usual designation of the interesting phenomenon which was seen here last night requires in strictness a slight modification to enable it accurately to describe what was visible with a powerful telescope. As thus seen, it might more correctly be termed "*Jupiter* without a visible Satellite *extraneous to his disc*." When all had in this sense disappeared, they were still, with the exception of the second, visible, as projected on the planet's disc.

The *first* was seen as a small bright spot near the eastern edge, to the south-east of its own shadow, and at less distance from it than its own diameter; the *third*, as a nearly round spot, partly bright and partly very dark—in fact, almost black; and the *fourth*, as a nearly round spot, so dark as scarcely to be distinguished by its colour from its own shadow, which, however, was much larger than itself.

Observing with an exquisitely perfect 8-inch refractor by Cooke & Sons, I noticed nothing unusual in the first satellite or its shadow. This was far from being the case with the *third*, the appearance of which was very remarkable. Considering how near it was to the planet's centre, its NE. side was strikingly bright. On the contrary, the SW. half was extraordinarily dark—scarcely less so than its shadow. During transient fits of fine definition, the form of the dark part was clearly discernible; but, though the shape reminded one forcibly of the figure which I have seen and depicted on former occasions (see Mon. Not. R.A.S., April 1860, figs. 2 and 3), yet the dark portion of the satellite was almost precisely on the opposite side of its disk; (appearing thus)—



The bright part of the satellite seemed to project a little beyond the contour of the circle, as if by irradiation; so that taking the dark and bright portions together, the satellite appeared slightly elongated in the direction NE. to SW.

The *fourth* satellite was also a remarkable object, the whole of its disc being so extremely dark as scarcely to be distinguished from its shadow, except by the smaller size of the satellite. The closest scrutiny of the

shadow failed to detect any decided diminution of its blackness towards its circumference; so that not only the extent of the penumbra, but even its existence, was not to be certainly perceived. The same may be said of the shadow of the third satellite.

When the image was sufficiently free from light cloud and tremour, the most efficient power on the 8-inch refractor was 412.

I remain, yours faithfully,

Hopefield Observatory, Haddenham, Bucks: W. R. DAWES.
1867: August 22.

TO THE EDITOR OF THE ASTRONOMICAL REGISTER.

Sir,—Not having seen any account of the astronomical phenomenon on the 21st August last agreeing altogether with my observation of it through my 9-inch equatorial, perhaps the following account may be acceptable to your readers.

The weather here appeared likely to be indifferent, and, from the position of the planet, I did not expect a good view of the commencement of the transit; but the clouds gradually cleared off, and I saw the planet well before the ingress of the third satellite, which was clearly defined, and, at that time, its black shadow was on the disc. As the shadow of the third satellite passed on towards the opposite side of the planet, and when the shadow of the fourth satellite came on the disc, I saw distinctly the third satellite itself half way between the shadow of the third and fourth satellites, and with wonder and delight, I distinctly perceived such third satellite to be of a cinnamon colour, with two spots connected together, of a darker cinnamon or *sponge* shade, towards the apparent east side. Then the fourth satellite made its appearance on the disc, and, to my great surprise, it was as black as its shadow, and apparently of about the same size, or a little smaller.

Soon after that, the shadow of the first satellite came in view, followed in a few minutes by the first satellite itself, which was of a pale cinnamon, or straw colour; and the second satellite having become eclipsed, no satellite could then be seen beyond the range of the planet itself. The view of three satellites and three shadows, making six circular spots of the colours mentioned on the disc of the planet, was then intensely interesting, and the effect was much heightened by the appearance of the belts, which were most distinct, and chiefly of a beautiful pink rose colour, looking more like terrestrial clouds of that tint than I had ever before seen them. Before looking at the planet, I had seen Mr. Proctor's excellent drawing of the phenomenon, in the July, 1867, number of the *Popular Science Review*, and on referring to it again afterwards, the places of the satellites and their shadows appeared exactly as I had observed them at about the time indicated.

I did not note with care the exact times of the respective ingresses and egresses, or of the eclipse, but the times given in the *Nautical Almanac*, and by Mr. Proctor, for Greenwich, seemed correct.

I particularly invite attention to the colours of the satellites and of the belts as seen by me, and which I hope may agree with Mr. Dawes's description promised in your last number, and whose drawing, I trust, may be coloured.

Yours faithfully,

South Villa, near Worcester: THOMAS BARNEBY.
September 9, 1867.

TO THE EDITOR OF THE ASTRONOMICAL REGISTER.

Sir,—Respecting the appearance of Jupiter without his moons on the 21st ult., none of your correspondents seem to have been so favoured, atmospherically, as myself. They all omit to mention, or were unable to see, one of the most remarkable of the phenomena that night.

When Jupiter rose above the mist on the horizon, at about 8h. 20m. P.M., the sky was perfectly free from cloud, and the air beautifully calm and clear. The first, second, and fourth satellites were visible, and the shadow of the third distinctly seen on the face of the planet. But the most remarkable thing at that time was the extraordinary *dimness* of the fourth satellite; compared with the first, nearly below it, the latter appeared very much larger and brighter. This was so very noticeable, that I came to the conclusion astronomers had either made a mistake in the position of the satellites, or this was one of those rare instances when the fourth satellite has appeared so much fainter than its companions. At 10h. 15m. my observation was confirmed by seeing the fourth satellite itself on Jupiter's belt as a black spot, thereby proving that the duskiness of the satellite, which caused it to appear on Jupiter as a black spot, had also produced the faintness in its light before transit. I regret I was not able to discern the 3rd satellite before entering on Jupiter's face, as doubtless a similar dimness in its light would have been noticed to account for its subsequent appearance. My other observations correspond with those detailed in this month's *Register;* they were made with a $2\frac{3}{4}$-inch achromatic, power 250, which the state of the atmosphere allowed me to use with great success.

I am, Sir, yours truly,

Burton-on-Trent: Sept. 3, 1867. E. B. KNOBEL.

TO THE EDITOR OF THE ASTRONOMICAL REGISTER.

Sir,—On the night of the 21st of August the sky in this vicinity was obscured by dense clouds. At intervals only did the planet Jupiter become dimly visible, so that it was not possible to note the instant of transit of the third and fourth satellites on to the disc of the primary.

About 9h. 30m. the clouds became thinner, and the shadows of the two satellites just referred to were plainly seen in Mr. Barnes's $10\frac{1}{2}$-inch silvered-glass reflector, but the satellites themselves could not with certainty be made out. At this time Jupiter appeared absolutely without satellites in a 5-foot achromatic that was attached to the side of the large equatorial. The sky becoming clearer at 10h. 4m., the first satellite, which was third in the order of transit, was seen to touch the edge of the disc. After passing on to the disc to the extent of half its diameter, it seemed for a brief space to remain stationary, like a brilliant bead. Passing then on to the disc, its brilliancy rapidly diminished, although it remained visible until 11h. 30m., when the clouds closed up thick and heavy, and obscured all further view of this most interesting sight.

It is a most curious fact, requiring explanation, that the satellites should appear so brilliant as to be readily seen when they are on the edge of the planet, where the disc is brightest, and yet, as they approach the centre of the planet, traversing the dark belts, where by the force of contrast we should expect that they would be most plainly visible, that they should be almost lost to view, or, even as I have once witnessed on a very clear night, become absolutely imperceptible.

I am, Sir, your obedient servant,

Upper Holloway: Sept. 13. JOHN BROWNING.

TO THE EDITOR OF THE ASTRONOMICAL REGISTER.

Sir,—The disappearance of the satellites of this planet on August 21st was well seen here, and the various phenomena so nearly resemble the descriptions of your correspondents in the September number, that a detailed account would be but a wearisome repetition. There is, however, one very interesting particular of which I do not see any notice, viz., the closeness of the disc of III. and the shadow of IV. when entering on Jupiter's disc. In fact, they appeared in actual contact, much like the discs of a close double star, when strongly elongated or notched.

On referring to the *Nautical Almanac*, I find there was an interval of three minutes of time between the entering of III. and the shadow of IV. on the disc, which shows that they must have been very close, and also that III. had but just before overtaken and passed the shadow of IV. with such a minute difference of declination, that it must have been partially, if not totally, eclipsed in the shadow of its more distant neighbour.

This idea is further strengthened by the appearances presented to the telescope, in which the shadow of IV., at its first entering on the disc, was strangely elongated, the elongation speedily assuming the appearance of discs in contact, and as the greater velocity of III. carried it clear of the shadow of IV., they were observed to separate, the lighter tint of III. clearly distinguishing it from the shadow of IV., which was also much smaller. The least contemplation of the motions of the satellites will show that mutual eclipses may take place, and they probably do occur with considerable frequency; and though we have no recorded instance of the disappearance of a satellite from this cause, we must attribute this to the fact that, from the rapid movements of the satellites, such eclipses must be of very brief duration, and without proper calculation an observer would not be likely to be on the watch at the proper time.

During some fine intervals the disc of III. was repeatedly suspected to be spotted, the preceding limb being the darkest, but the tremulous state of the air rendered this uncertain.

The instrument used was the $6\frac{1}{2}$-inch silvered-glass reflector, described in the July *Register*, with the performance of which I have every reason to be highly gratified.

Yours very truly,

Sept. 1867. C. GROVER.

P.S.—The transits of I. and II. on the 30th were well seen here, and are worthy of note from the very different appearances of both satellites and shadows. The first satellite did not become visible till it approached the limb, when it appeared as a white spot on the bright equatorial channel, and the quickness with which it started into visibility, and increased to a clear, round, and well-defined disc, was something wonderful.

The second satellite, though traversing the dark south belt, was very obscure; even near the limb, the disc seemed very irregular, and was difficult of observation. The shadows were as different in appearance as the satellites: that of I. was sharp and well defined, and when half emerged from the planet, formed a curious indentation in its margin; while the shadow of II., though plainly seen, seemed very ill-defined and hazy, as if encompassed with a very dense penumbral shadow, and, when near the limb, barely visible.

TO THE EDITOR OF THE ASTRONOMICAL REGISTER.

Sir,—I enjoyed a fair view of the phenomena of Jupiter's satellites on the 21st August. I hope you were equally fortunate. The third appeared

as an irregular dusky spot for about an hour and a quarter. I made several rough sketches of the appearances at different times. I saw nothing on the 28th, owing to cloudy weather.

It must be a mistake on the part of the Astronomer Royal (*Register*, August), that this phenomenon of Jupiter without satellites has only been seen *twice*. It seems to have been observed *four* times.—See Herschel, *Outlines*, p. 363 (5th edition).

I am, Sir, faithfully yours,

Teignmouth: Sept. 1867. G. T. WALKER.

TO THE EDITOR OF THE ASTRONOMICAL REGISTER.

Sir,—I hope I may not be thought presuming if I trouble you with the facts which I and my brother observed on the interesting phenomenon of August 21.

I should not have ventured an opinion at all, but that I was surprised at the results printed in the correspondence referring to it in the September number.

In this correspondence, it seems to me that Mr. F. Bird was the only one who saw the real state of the case, namely, that the two extra dark spots *were not* the satellites, but that they were *beside* and *touched* the true satellites.

Our observation was as follows: On first looking, the first satellite was off the disc, but his shadow was on it; its transit was observed by my brother, who, while he was looking, remarked a fine shadow on the advancing side of the satellite, of a crescent shape and very narrow, the satellite being then only half on the planet's disc. Presently, I looked myself and saw this shadow; it was then wider and more plain (on account of being on a brighter part of the planet, whose edges fading rapidly in brightness cause the satellite to be very distinctly visible at first, but more faint as it advances on, and *vice versâ* with a shadow). It continued visible as distinct from both the true shadow and the true satellite as long as we observed. The same phenomenon I observed on the third satellite, which remained equally distinct from and yet in contact with the false pale shadow; the fourth satellite had no such shadow, neither was it at all visible. Thus there were the three true shadows and the two false ones, making five spots as observed.

I will not affirm that the satellites appeared to *occult* these faint shadows, only that, being quite in contact and long north and south, the conclusion is probable.

The only explanation I can find for all this is, that the first and third satellites *have atmospheres*, and that this pale shadow was in that atmosphere. The following seems to me incontrovertible: 1st, That they did not belong to the planet (for if so, on what could they be thrown?). 2nd, That they were not the satellites: in the case of the first I am quite confident; the third was more delicate, yet we saw it, and so did Mr. Bird. 3rd, They were not opaque, for they did not notch the edge of the planet.

The above conclusion, then, seems to me inevitable.

With this idea, I have examined the satellites separately, and have already obtained these results: September 4th, The third satellite had a vapour round it, absent on the fourth; the fourth a redder and lower colour than the third, (observed with $3\frac{3}{4}$ aperture). September 5th, The third satellite a clear disc, a halo probable; the fourth, *certainly* lower in tone and redder than third, showed a *clearer* disc. I made nothing certain about the double transit of September 6th, on account of the wind.

The questions to be settled, then, are these: Were these shadows too broad considering that they must be much foreshortened? Do these sha-

dows always appear as belonging to the first and third satellites? Does the fourth ever have this false shadow? Have the first and third constant halos? Do the satellites have a constant characteristic difference in these respects.

The first question must be overruled if the others are all answered in favour of the atmospheric theory.

I omitted to say that the darker and redder colour of the fourth satellite is plainly the reason of his non-appearance on the planet's disc.

All these observations, except the one otherwise stated, were made with 6-inch aperture.

I anxiously await Mr. Dawes' letter, and have written before I see it, so that any observed coincidence may tell for its full value.

I hope I have not transgressed too freely upon your valuable space, and remain yours obediently,

The Cedars, Chiswick, W.: A. DAWSON.
Sept. 10, 1867.

JUPITER WITH ONE SATELLITE.

TO THE EDITOR OF THE ASTRONOMICAL REGISTER.

Sir,—On the 28th of August last, I had an excellent view of Jupiter in this condition. The third satellite, as it entered the disc of Jupiter, behaved precisely as it did on August 21, and became a dark body. I watched with my reflector, using a power of 119, this satellite's progress, and saw the gradual change from light to dark.

It entered the disc, and remained perfectly plain as a luminous body during its passage across the duller parts of Jupiter's margin, but soon after this, as it entered the stronger light of the planet, it faded rapidly and became dark grey, and finally brownish, and might easily have been mistaken for one of the shadows. This transformation was the more singular as the first satellite continued to shine with its pale light, without the slightest symptom of change, in front of its inky shadow, until clouds came on at 12.30, when no more was seen. The shadows and the dark satellite, at this time, had arranged themselves into the form of an equilateral triangle, —the latter being at the apex.

As during the present autumn, Jupiter will be well situated for observation, it is to be hoped the immersions and transits of the satellites will be carefully watched, with a view to ascertain the cause of these anomalous dark appearances, whether arising from dark spots on their surfaces, or from the mere effect of contrast; and also what proportion the dark transits bear to the luminous ones, and the order in which they occur.

I am, Sir, yours faithfully,

Birmingham: Sept. 12, 1867. F. BIRD.

JUPITER'S SATELLITES.

TO THE EDITOR OF THE ASTRONOMICAL REGISTER.

Sir,—In reference to a letter from Mr. Banks, in the number for September, I may say that I have often seen the third satellite of Jupiter with the unassisted eye, and when no other satellite has been near enough to produce any effect favourable to seeing it from the addition of light from the others. In fact, if the third satellite is distant a few diameters off Jupiter, I can generally see it. Not always, however. To test the matter,

I have previously looked at Jupiter with the unassisted eye, and desired a friend to find it in the telescope, when my description of its position has agreed with its position in the telescope. And many times I have done as Mr. Banks did, *i.e.* looked first with the unassisted eye, and then tested the correctness of my sight with an instrument. At the same time, it is very probable that, in many of the recorded instances of visibility of a satellite with the naked eye, two or more have been juxtaposed, as in the cases which Mr. Banks cites. My own plan usually has been to look between the fingers of one or both hands, shifting them so as just to cut off the rays preceding and following in which positions the satellites always lie.

Another thing I have several times noticed—these little bodies are not always of the sizes as given in the order of Struve's measurements, viz. III. IV., I., II. I have repeatedly found IV. the smallest and palest of all. At other times II. has been superior to I. and nearly equal to III. These changes could not be accounted for by their juxtaposition with Jupiter. Has any one ever suggested a *law* for these changes? Will a rapid rotation (compared with the time of their revolutions) always agree with the phenomena which Secchi, Lassell, and others are said to have observed?

Possibly they may be invested with clouds as proportionately extensive as their primary has. If their variable light is occasioned always by the appearance of dark spots, may the latter not be temporary dark openings revealing a less reflective ground, and not merely the appearance produced by a regular rotation, revealing permanent *mares* to us?

What will explain, too, the appearance of III. as a *darker* spot on the disc of Jupiter than one of the *dark* belts of the latter, as no doubt many of your readers saw on the evening of the 21st of August, and several shades I thought from its visibility on that occasion, although in the open sky it generally is so brilliant? It seems to me that there must have been extensive spots really darker than Jupiter's belt.

Has any explanation been offered to account for the shadows of the satellites in transit being *larger* than the satellite itself, although irradiation would give entirely opposite effects?

Is it not possible that on so bright a background the penumbra is to us combined with the true shadow, and at present has not yet been distinguished from it (so far as I have heard), and thus the shadows appear larger instead of somewhat smaller?

Does Mr. Bird, in the extract from his letter respecting the appearance of Jupiter on the 21st of August, mean that he saw the satellites as *pale* objects in addition to the *extra dark* spots which he expresses himself at a loss to account for? Mr. Webb, in "Celestial Objects," mentions that Sir J. South once saw two shadows with two faint duplicates. Was Mr. Bird's a similar observation?

Yours truly,

Earith, near St. Ives, Hunts: T. H. BUFFHAM.

Sept. 9, 1867.

THE ECLIPSE OF THE MOON LAST MONTH.

On the evening of the 13th of September the sky was beautifully clear and an excellent view of the eclipse was obtained. At Ramsgate, it was observed by the editor of the *Register* with a portable *Dollond* telescope of 2 inches aperture; nothing unusual was seen—the shadow towards the north-east of the moon's