

Day Two: Wednesday Morning, August 26, 1835

GREAT ASTRONOMICAL DISCOVERIES

Lately Made

BY SIR JOHN HERSCHEL, L.L.D, F.R.S, &c.

At The Cape of Good Hope.

[From Supplement to the Edinburgh Journal of Science]

[Continued from yesterday's Sun]

A correspondence had for some time passed between the Boards of England, France, and Austria, with a view to improvements in the tables of longitude in the southern hemisphere; which are found to be much less accurate than those of the northern. The high opinion entertained by the British Board of Longitude of the principles of the new telescope, and of the profound skill of its inventor, determined the government to solicit his services in observing the transit of Mercury over the sun's disk, which will take place on the 7th of November in the present year: and which, as it will occur at 7h. 57m. 55s. night, conjunction, meantime; and at 8h. 12m. 22s. middle, true time, will be invisible to nearly all the northern hemisphere.

The place at which the transits of Mercury and of Venus have generally been observed by the astronomers of Europe, when occurring under these circumstances, is the Cape of Good Hope; and no transit of Venus having occurred since the year 1769, and none being to occur before 1874, the accurate observation of the transits of Mercury, which occur more frequently, has been found of great importance both to astronomy and navigation. To the latter useful art, indeed, the transits of Mercury are nearly as important as those of Venus; for although those of the latter planet have the peculiar advantage of determining exactly the great solar parallax, and thence the distances of all the planets from the sun, yet the transits of Mercury, by exactly determining the place of its own node, independently of the parallax of the great orb, determine the parallax of the earth and moon; and are therefore especially valuable in solar observations of Longitude. The Cape of Good Hope has been found preferable, in these observations, to any other station in the hemisphere.

The expedition which went to Peru, about the middle of the last century, to ascertain, in conjunction with another in Lapland, the true figure of the earth, found the attraction of the mountainous regions so strong as to cause the plum-line of one of their large instruments to deflect seven or eight seconds from the true perpendicular; whilst the elevated plains at the Cape unite all the advantages of a lucid atmosphere with an entire freedom from mountainous obstruction. Sir John Herschel, therefore, not only accepted the appointment with high satisfaction, but requested that it might commence at least a year before the period of the transit, to afford him time to bring his ponderous and complicated machinery into perfect adjustment, and to extend his knowledge of the southern constellations.

His wish was immediately assented to, and his arrangements being completed, he sailed from London on the 4th of September, 1834, in company with Dr. Andrew Grant, Lieutenant Drummond, of the Royal Engineers, F.R.A.S., and a large party of the best English mechanics. They arrived, after an expeditious and agreeable passage, and immediately proceeded to transport the lens, and the frame of the large observatory, to its destined site, which was a piece of

table-land of great extent and elevation, about thirty-five miles to the north-east of Capetown; and which is said to be the very spot on which De la Caille, in 1750, constructed his invaluable solar tables, when he measured a degree of the meridian, and made a great advance to exactitude in computing the solar parallax from that of Mars and the Moon. Sir John accomplished the ascent to the plains by means of two teams of oxen, of eighteen each, in about four days; and, aided by several companies of Dutch boors, proceeded at once the erection of his gigantic fabric.

The ground plan of the structure is in some respects similar to that of the Herschel telescope in England, except that instead of circular foundations of brickwork, it consists of parallel circles of railroad iron, upon wooden framework; so constructed that the turn-outs, or rather turn-ins, from the largest circle, will conduct the observatory, which moves upon them, to the innermost circle, which is the basis of the lens-works; and to each of the circles that intervene. The diameter of the smallest circle is twenty-eight feet: that of the largest our correspondent has singularly forgotten to state, though it may be in some measure computed from the angle of incidence projected by the lens, and the space occupied by the observatory. The latter is a wooden building fifty feet square and as many high, with a flat roof and gutters of thin copper. Through the side proximate to the lens, is an aperture four feet in diameter to receive its rays, and through the roof another for the same purpose in meridional observations.

The lens, which is enclosed in a frame of wood, and braced to its corners by bars of copper, is suspended upon an axis between two pillars which are nearly as high as those which supported the celebrated quadrant of Uleg Beg, being one hundred fifty feet. These are united at the top and bottom by cross-pieces, and strengthened by a number of diagonal braces; and between them is a double capstan for hoisting the lens from its horizontal line with the observatory to the height required by its focal distance when turned to the meridian; and for elevating it to any intermediate degree of altitude that may be needed. This last operation is beautifully regulated by an immense double sextant, which is connected and moves with the axis of the lens, and is regularly divided into degrees, minutes and seconds; and the horizontal circles of the observatory being also divided into 360 degrees, and minutely subdivided, the whole instrument has the powers and regularity of the most improved theodolite. Having no tube, it is connected with the observatory by two horizontal levers, which pass underneath the floor of that building from the circular basis of the pillars; thus keeping the lense always square with the observatory, an securing to both a uniform and simple movement. By means of these levers, too, a rack and windlass, the observatory is brought to any degree of approximation to the pillars that the altitude of an observation may require; and although, when at its nearest station it cannot command an observation with the great lens within about fifteen degrees of the meridian, it is supplied with an excellent telescope of vast power, constructed by the elder Herschel, by which every high degree can be surveyed. The field of view, therefore, whether exhibited on the floor or the wall of the apartment, has a diameter of nearly fifty feet, and being circular, it has therefore an area of 1875 feet.

The place of all the horizontal movements having been accurately levelled by Lieut. Drummond, with the improved level of his invention which bears his name, and the wheels

both of the observatory and of the lens-works being facilitated by friction-rollers in patent axle-boxes filled with oil, the strength of one man applied to the extremity of the levers is sufficient to propel the whole structure upon either of the railroad circles; and that of two men applied to the windlass is fully adequate to bring the observatory to the basis of the pillars. Both of these movements, however, are now effected by a locomotive apparatus commanded within the apartment by a single person, and showing, by means of an ingenious index, every inch of progression or retrogression.

We have not thus particularly described the telescope of the younger Herschel because we consider it the most magnificent specimen of philosophical mechanism of the present or any previous age, but because we deemed an explicit description of its principles and powers an almost indispensable introduction to a statement of the sublime expansion of human knowledge which is has achieved. It was not fully completed until the latter part of December, when the series of large reflectors for the microscope arrived from England; and it was brought into operation during the first week of the ensuing month and year. But the secrecy which had been maintained with regard to its novelty, its manufacture, and its destination, was not less rigidly preserved for several months respecting the grandeur of its success. Whether the British Government were sceptical concerning the promised splendor of its discoveries, or wished them to be scrupulously veiled until they had accumulated a full-orbed glory for the nation and reign in which they originated, is a question which we can only conjecturally solve. But certain it is that the astronomer's royal patrons enjoined a masonic taciturnity upon him and his friends until he should have officially communicated the results of his great experiment.

Accordingly, the world heard nothing of him or his expedition until it was announced a few months since in the scientific journals of Germany, that Sir John Herschel, at the Cape of Good Hope, had written to the astronomer-royal of Vienna, to inform him that the portentous comet predicted for the year 1835, which was to approach so near this trembling globe that we might hear the roaring of its fires, had turned upon another scent, and would not even shake a hair of its tail upon our hunting-grounds. At a loss to conceive by what extra authority he had made so bold a declaration, the men of science of Europe who were not acquainted with his secret, regarded his "postponement," as his discovery was termed, with incredulous contumely, and continued to terrorize upon the strength of former predictions.

NEW LUNAR DISCOVERIES

Until the 10th of January, the observations were chiefly directed to the stars in the southern signs, in which, without the aid of the hydro-oxygen reflectors, a countless number of new stars and nebulae were discovered. But we shall defer our correspondent's account of these to future pages for the purpose of no longer withholding from our readers the more generally and highly interesting discoveries which were made in the lunar world. And for this purpose, too, we shall defer Dr. Grants elaborate mathematical details of the corrections which Sir John Herschel has made in the best tables of the moon's tropical, sidercal, and synodic on which a great part of the established lunar theory depends.

It was about half past nine o'clock on the night of the tenth, the moon having then advanced within four days of her mean liberation, that the astronomer adjusted his instruments for the inspection of her eastern limb. The whole immense power of his telescope was applied and to its focal image about one half of the power of his microscope. On removing the screen of the latter, the field of view was covered throughout its entire area with a beautifully distinct, and even vivid representation of basaltic rock. Its color was a greenish brown, and the width of the columns, as defined by their interstices on the canvass, was invariably twenty-eight inches. No fracture whatever appeared in the mass first presented, but in a few seconds a shelving pile appeared of five or six columns width, which showed their figure to be hexagonal, and their articulations similar to those of the basaltic formation at Staffa. This precipitous shelf was profusely covered with a dark red flower, "precisely similar," says Dr. Grant, "to the Papaver Rhoeas, or rose-poppy of our sublunary cornfields; and this was the first organic production of nature, in a foreign world, ever revealed to the eyes of men."

The rapidity of the moon's ascension, or rather of the earth's diurnal rotation, being nearly equal to five hundred yards in a second, would have effectually prevented the inspection, or even the discovery of objects so minute as these, but for the admirable mechanism which constantly regulates, under the guidance of the sextant, the required altitude of the lens. But its operation was found to be so consummately perfect, that the observers could detain the object upon the field of view for any period they might desire. The specimen of lunar vegetation, however, which they had already seen, had decided a question of too exciting an interest to induce them to retard its exit. It had demonstrated that the moon has an atmosphere constituted similarly to our own, and capable of sustaining organized, and therefore, most probably animal life. The basaltic rocks continued to pass over the inclined canvass plane, through three successive diameters, when a verdant declivity of great beauty appeared, which occupied two more. This was preceded by another mass of nearly the former height, at the base of which they were at length delighted to perceive that novelty, a lunar forest. "The trees," says Dr. Grant, "for a period of ten minutes, were of one unvaried kind, and unlike any I have seen, except the largest kind of yews in the English churchyards, which they in some respects resemble. These were followed by a level green plain, which, as measured by the painted circle on our canvass of forty-nine feet, must have been more than half a mile in breadth; and then appeared as fine a forest of firs, unequivocal firs, as I have ever seen cherished in the bosom of my native mountains.

Wearied with the long continuance of these, we greatly reduced the magnifying power of the microscope, without eclipsing either of the reflectors, and immediately perceived that we had been insensibly descending, as it were, a mountainous district of a highly diversified and romantic character, and that we were on the verge of a lake, or inland sea; but of what relative locality or extent, we were yet too greatly magnified to determine. On introducing the feeblest acromatic lens we possessed, we found that the water, whose boundary we had just discovered, answered in general outline to the Mare Nubium of Riccoli, by which we detected that, instead of commencing, as we supposed, on the eastern longitude of the planet, some delay in the elevation of the great lens had thrown us nearly upon the axis of her

equator.

However, as she was a free country, and we not, as yet, attached to any particular province, and moreover, since we could at any moment occupy our intended position, we again slid our magic lenses to survey the shores of the Mare Nubium. Why Riccoli so termed it, unless in ridicule of Cleomedes, I know not; for fairer shores never angels coasted on a tour of pleasure. A beach of brilliant white sand, girt with wild castellated rocks, apparently of green marble, varied at chasms, occurring every two or three hundred feet, with grotesque blocks of chalk or gypsum, and feathered and festooned at the summit with the clustering foliage of unknown trees, moved along the bright wall of our apartment until we were speechless with admiration. The water, we obtained a view of it, was nearly as blue as that of the deep ocean, and broke in large white billows upon the strand. The action of very high tides was quite manifest upon the face of the cliffs for more than a hundred miles; yet diversified as the scenery was during this and a much greater distance, we perceived no trace of animal existence, notwithstanding we could command at will a perspective or a foreground view of the whole. Mr. Holmes, indeed, pronounced some white objects of a circular form, which we saw at some distance in the interior of a cavern, to be bona fide specimens of a large cornu ammonis; but to me they appeared merely large pebbles, which had been chafed and rolled there by the tides. Our chase of animal life was not yet to be rewarded.

Having continued this close inspection of nearly two hours, during which we passed over a wide tract of country, chiefly of a rugged and apparent volcanic character; and having seen few additional varieties of vegetation, except some species of lichen, which grew everywhere in great abundance, Dr. Herschel proposed that we should take out all our lenses, give a rapid speed to the panorama, and search for some of the principal valleys known to astronomers, as the most likely method to reward our first night's observation with the discovery of animated beings. The lenses being removed, and the effulgence of our unutterably glorious reflectors left undiminished, we found in accordance with our calculations, that our field of view comprehended about twenty-five miles of the lunar surface, with the distinctness both of outline and detail which could be procured of a terrestrial object at a distance of two and a half miles; an optical phenomenon which you will find demonstrated in Note 5. This afforded us the best landscape views we had hitherto obtained, and although the accelerated motion was rather too great, we enjoyed them with rapture.

Several of these famous valleys, which are bounded by lofty hills of so perfectly conical a form as to render them less like works of nature than of art, passed the canvass before we had time to check their flight; but presently a train of scenery met our eye, of features so entirely novel, that Dr. Herschel signalled for the lowest convenient gradation of movement. It was a lofty chain of obelisk-shaped, or very slender pyramids, standing in irregular groups, each composed of about thirty or forty spires, every one of which was perfectly square, and as accurately truncated as the finest specimens of Cornish crystal. They were of a faint lilac hue, and very resplendent. I now thought that we had assuredly fallen on productions of art; but Dr. Herschel shrewdly remarked, that if the Lunarians could build thirty or forty miles of such monuments as these, we should ere now have discovered others of a less equivocal character. He pronounced them quartz

formations, of probably wine-colored amethyst species, and promised us, from these and other proofs which he had obtained of the powerful action of laws of crystallization in this planet, a rich field of mineralogical study.

On introducing a lens, his conjecture was fully confirmed; they were monstrous amethysts, of a diluted claret color, glowing in the intensest light of the sun! They varied in height from sixty to ninety feet, though we saw several of a still more incredible altitude. They were observed in a succession of valleys divided by longitudinal lines of round-breasted hills, covered with verdure and nobly undulated; but what is most remarkable, the valleys which contained these stupendous crystals were invariably barren, and covered with stones of a ferruginous hue, which were probably iron pyrites. We found that some of these curiosities were situated in a district elevated half a mile above the valley of the Mare Foecunditatis, of Mayer and Riccoli; the shores of which soon hove into view. But never was a name more appropriately bestowed, From "Dan to Bersheba" all was barren, barren - the sea-board was entirely composed of chalk and flint, and not a vestige of vegetation could be discovered with our strongest glasses.

The whole breadth of the northern extremity of the sea, which was about three hundred miles, having crossed our plane, we entered upon a wild mountainous region abounding with more extensive forests of larger trees than we had seen before -- the species of which I have no good analogy to describe. In general contour they resembled our forest oak; but they were much more superb in foliage, having broad glossy leaves like that of the laurel, and tresses of yellow flowers which hung, in the open glades, from the branches to the ground. These mountains passed, we arrived at a region which filled us with utter astonishment. It was an oval valley, surrounded, except at narrow opening towards the south, by hills, red as the purest vermilion, and evidently crystallized; for wherever a precipitous chasm appeared -- and these chasms were very frequent, and of immense depth -- the perpendicular sections present conglomerated masses of polygon crystals, evenly fitted to each other, and arranged in deep strata, which grew darker in color as they descended to the foundations of the precipices. Innumerable cascades were bursting forth from the breasts of every one of these cliffs, and some so near their summits, and with such great force, as to form arches many yards in diameter. I never was so vividly reminded of Byron's simile, "the tale of the white horse in the Revolution." At the foot of this boundary of hills was a perfect zone of woods surrounding the whole valley, which was about eighteen or twenty miles wide, at its greatest breadth, and about thirty in length. Small collections of trees, of every imaginable kind, were scattered about the whole of the luxuriant area; and here our magnifiers blest our panting hopes with specimens of conscious existence.

In the shade of the woods on the south-eastern side, we beheld continuous herds of brown quadrupeds, having all the external characteristics of the bison, but more diminutive than any species of the bos genus in our natural history. Its tail is like that of our bos grunniens; but in its semi-circular horns, the hump on its shoulders, and the depth of its dewlap, and the length of its shaggy hair, it closely resembled the species to which I first compared it. It had, however, one widely distinctive feature, which we afterwards found common to nearly every lunar quadruped we have discovered; namely, a remarkable fleshy appendage over the eyes, crossing the whole breadth of the forehead and

united to the ears. We could most distinctly perceive this hairy veil, which was shaped like the upper front outline of a cap known to the ladies as Mary Queen of Scots' cap, lifted and lowered by means of the ears. It immediately occurred to the acute mind of Dr. Herschel, that this was a providential contrivance to protect the eyes of the animal from the extremes of light and darkness to which all the inhabitants of our side of the moon are periodically subjected.

The next animal perceived would be classed on earth as a monster. It was of a bluish lead color, about the size of a goat, with a head and beard like him, and a single horn, slightly inclined forward from the perpendicular. The female was destitute of horn and beard, but had a much longer tail. It was gregarious, and chiefly abounded on the acclivitous glades of the woods. In elegance of symmetry it rivalled the antelope, and like him it seemed an agile sprightly creature, running with great speed, and springing from the green turf with all the unaccountable antics of a young lamb or kitten. This beautiful creature afforded us the most exquisite amusement. The mimicry of its movements upon our white painted canvass was as faithful and luminous as that of animals within a few yards of the camera obscura, when seen pictures upon its tympan. Frequently when attempting to put our fingers upon its beard, it would suddenly bound away into oblivion, as if conscious of our earthly impertinence; but then others would appear, whom we could not prevent from nibbling the herbage, say or do what we would to them.

On examining the centre of this delightful valley, we found a large branching river, abounding with lovely islands, and water-birds of numerous kinds. A species of grey pelican was the most numerous; but a black and white crane, with unreasonably long legs and bill, were also quite common. We watched their pisciverous experiments a long time, in hopes of catching sight of a lunar fish; but although we were not gratified in this respect, we could easily guess the purpose with which they plunged their long necks so deeply beneath the water. Near the upper extremity of one of these islands we obtained a glimpse of a strange amphibious creature, of a spherical form, which rolled with great velocity across the pebbly beach, and was lost sight of in the strong current which set off from this angle of the island. We were compelled, however, to leave this prolific valley unexplored, on account of clouds which were evidently accumulating in the lunar atmosphere, our own being perfectly translucent. But this was itself an interesting discovery, for more distant observers had questioned or denied the existence of any humid atmosphere in this planet.

The moon being now low on her descent, Dr. Herschel inferred that the increasing refrangibility of her rays would prevent any satisfactory protraction of our labors, and our minds being actually fatigued with the excitement of the high enjoyments we had partaken, we mutually agreed to call in the assistants at the lens, and reward their vigilant attention with congratulatory bumpers of the best "East Indian Particular." It was not, however, without regret that we left the splendid valley of the red mountains, which, in compliment to the arms of our royal patron, we denominated "the Valley of the Unicorn;" and it may be found in Blunt's map, about midway between the Mare Faecunditatis and the Mare Nectaris.

The nights of the 11th and 12th being cloudy, were unfavorable to observation; but on those of the 13th and

14th further animal discoveries were made of the most exciting interest to every human being. We give them in the graphic language of our accomplished correspondent:-

[\[To be continued.\]](#)