GREAT ASTRONOMICAL DISCOVERIES
Lately Made
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At The Cape of Good Hope.

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In this unusual addition to our Journal, we have the happiness of making known to the British publick, and thence to the whole civilized world, recent discoveries in Astronomy which will build an imperishable monument to the age in which we live, and confer upon the present generation of the human race a proud distinction through all future time. It has been poetically said, that the stars of heaven are the hereditary regalia of man, as the intellectual sovereign of the animal creation. He may now fold the Zodiack around him with a loftier conscientiousness of his mental supremacy.

It is impossible to contemplate any great Astronomical discovery without feelings closely allied to a sensation of awe, and nearly akin to those with which a departed spirit may be supposed to discover the realities of a future state. Bound by the irrevocable laws of nature to the globe on which we live, creatures "close shut up in infinite expanse," it seems like acquiring a fearful supernatural power when any remote mysterious works of the Creator yield tribute to our curiosity. It seems almost a presumptious assumption of powers denied to us by divine will, when man, in the pride and confidence of his skill, steps forth, far beyond the apparently natural boundary of his privileges, and demands the secrets and familiar fellowship of other worlds.

We are assured that when the immortal philosopher to whom mankind is indebted for the thrilling wonders now first made known, had at length adjusted his new and stupendous apparatus with the certainty of success, he solemnly paused several hours before he commenced his observations, that he might prepare his own mind for discoveries which he knew would fill the minds of myriads of his fellow-men with astonishment, and secure his name a bright, if not transcendent conjunction with that of his venerable father to all posterity.

And well he might pause! From the hour the first human pair opened their eyes to the glories of the blue firmament above them, there has been no accession to human knowledge at all comparable in sublime interest to that which he has been the honored agent in supplying; and we are taught to believe that, when a work, already preparing for the press, in which his discoveries are embodied in detail, shall be laid before the public, they will be found of incomparable importance to some of the grandest operations of civilized life.

Well might he pause! He was about the become the sole depository of wondrous secrets which had been hid from the eyes of all men that had lived since the birth of time. He was about to crown himself with a diadem of knowledge which would give him a conscientious pre-eminence above every individual of his species who then lives, or who had lived in the generations that are passed away. He paused ere he broke the seal of the casket which contained it.

To render our enthusiasm intelligible, we will state at once, that by means of a telescope of vast dimensions and en entirely new principle, the younger Herschel, at his

observatory in the Southern Hemisphere, has already made the most extraordinary discoveries in every planet of our solar system; has discovered planets in other solar systems; has obtained a distinct view of objects in the moon, fully equal to that which the naked eye commands of terrestrial objects at the distance of a hundred yards; has affirmatively settled the question whether this satellite be inhabited, and by what order of things; has firmly established a new theory of cometary phenomena; and has solved or corrected nearly every leading problem of mathematical astronomy.

For our early and almost exclusive information concerning these facts, we are indebted to the devoted friendship of Dr. Andrew Grant, the pupil of the elder, and for several years past the inseparable coadjutor of the younger Herschel. The amanuensis of the latter at the Cape of Good Hope, and the indefatigable superintendent of his telescope during the whole period of its construction and operation, Dr. Grant has been enabled to supply us with intelligence equal, in general interest at least, to that which Dr. Herschel himself has transmitted to the Royal Society. Indeed our correspondent assures us that the voluminous documents now before a committee of that institution contain little more than details and mathematical illustrations of the facts communicated to us in his own ample correspondence.

For permission to indulge his friendship in communicating this invaluable information to us, Dr. Grant and ourselves are indebted to the magnanimity of Dr. Herschel. who, far above all mercenary considerations, has thus signally honored and rewarded his fellow-laborer in the field of science. The engravings of lunar animals and other objects, and of the phases of the several planets, are accurate copies of drawings taken in the observatory by Herbert Home, Esq., who accompanied the last powerful series of reflectors from London to the Cape, and superintended their erection; and he has thus recorded the proofs of their triumphant success. The engravings of the belts of Jupiter is a reduced copy of the imperial folio drawing by Dr. Herschel himself, and contains the results of his latest observation of that planet. The segment of the inner ring of Saturn is from a large drawing by Dr. Grant.

We first avail ourselves of the documents which contain a description and history of the instrument by which there stupendous discoveries have been made. A knowledge of the one is essential to the credibility of the other.

THE YOUNGER HERSCHEL'S TELESCOPE

It is well known that the great reflecting telescope of the late elder Herschel, with an object-glass four feet in diameter, and a tube forty feet in length, possesses a magnifying power of more than six thousand times. But a small portion of this power was ever advantageously applied to the nearer astronomical objects; for the deficiency of light from objects so highly magnified, rendered them less distinct than when viewed with a power of a third or a fourth of this extent. Accordingly the powers which he generally applied when observing the moon or planets, and with which he made his most interesting discoveries, ranged from 220, 460, 750 and 900 times; although, when inspecting the double and treble fixed stars, and the more distant nebulae, he frequently applied the full capacity of his instrument. The law of optics, that an object becomes dim in proportion as it is magnified, seemed, from its exemplification in this powerful telescope, to form an

insuperable boundary to further discoveries in our solar system. Several years, however, prior to the death of this venerable astronomer, he conceived it practicable to construct an improved series of parabolic and spherical reflectors, which, by uniting all the meritorious points in the Gregorian and Newtonian instruments, with the highly interesting achromatic discovery of Dolland, would, to a great degree, remove the formidable obstruction. His plan evinced the most profound research in optical science, and the most dexterous ingenuity in mechanical contrivance; but accumulating infirmities, and eventual death, prevented its experimental application.

His son, the present Sir John Herschel, who had been nursed and cradled in the observatory, and a practical astronomer from his boyhood, was so fully convinced of the value of the theory, that he determined upon testing it, at whatever cost. Within two years of his father's death he completed his new apparatus, and adapted it to the old telescope with nearly perfect success. He found that the magnifying power of 6,000 times, when applied to the moon, which was the severest criterion that could be selected, produced, under these new reflectors, a focal object of exquisite distinctness, free from every achromatic obscurity, and containing the highest degree of light which the great speculum could collect from that luminary.

The enlargement of the angle of vision which was thus acquired, is ascertained by dividing the moon's distance from the observatory by the magnifying power of the instrument; and the former being 240,000 miles, and the latter 6,000 times, leaves a quotient of 40 miles as the apparent distance of that planet from the eye of the observer. Now it is well known that no terrestrial objects can be seen at a greater distance than this, with the naked eye, even from the most favorable elevations. The rotundity of the earth prevents a more distant view than this with the most acute natural vision, and from the highest eminences; and, generally, objects seen at this distance are themselves elevated on mountainous ridges. It is not pretended, moreover, that this forty miles telescopic view of the moon presented its objects with equal distinctness, though it did in equal size to those of this earth, so remotely stationed.

The elder Herschel had nevertheless demonstrated, that with a power of 1,000 times, he could discern objects in this satellite of not more than 122 yards in diameter. If therefore the full capability of the instrument had been elicited by the new apparatus of reflectors constructed by his son, it would follow, in mathematical ratio, that objects could be discerned of not more than 22 yards in diameter. Yet in either case they would be seen as mere feeble, shapeless points, with no greater conspicuity than they would exhibit upon earth to the unaided eye at the distance of forty miles. But although the rotundity of the earth presented no obstruction to a view of these astronomical objects, we believe Sir John Herschel never insisted that he had carried out these extreme powers of the telescope in so full a ratio.

The deficiency of light, though greatly economized and concentrated, still maintained some inverse proportion to the magnitude of this planet, though magnificent and sublime, enabled to confirm some discovered of former observers, and to confute those of others. The existence of volcanoes discovered by his father and by Schroeter of Berlin, and the changes observed by the latter in the volcano in the Mare Chrisium of Lucid Lake, were corroborated and illustrated, as was also the prevalence of

far more extensive volcanic phenomena. The disproportionate height attributed to the lunar mountains was corrected from careful admeasurement; whilst the celebrated conical hills, encircling valleys of vast diameter, and surrounding the lofty central hills, were distinctly perceived. The formation which Professor Frauenhofer uncharitably conjectured to be lunar fortifications, he ascertained to be a tubular buttress of a remarkably pyramidical mountain; line which had been whimsically pronounced roads and canals, he found to be keen ridges of singularly regular rows of hills; and that which Schroeter imagined to be a great city in the neighborhood of Marius, he determined to be a valley of disjointed rocks scattered in fragments, which averaged al least a thousand yards in diameter.

Thus the general geography of the planet, in its grand outlines of cape, continent, mountain, ocean, and island, was surveyed with greater particularity and accuracy than by any previous observer; and the striking dissimilarity of many of its local features to any existing on our own globe, was clearly demonstrated. The best enlarged maps of that luminary which have been published were constructed from this survey; and neither the astronomer nor the public ventured to hope for any greater accession to their developments. The utmost power of the largest telescope in the world had been exerted in a new and felicitous manner to obtain them, and there was no reasonable expectation that a larger one would ever be constructed, or that it could be advantageously used if it were. A law of nature, and the finitude of human skill, seemed united in inflexible opposition to any further improvement in telescopic science, as applicable to the known planets and satellites of the solar system. For unless the sun could be prevailed upon to extend a more liberal allowance of light to these bodies, and they be induced to transfer it, for the generous gratification of our curiosity, what adequate substitute could be obtained? Telescopes do not create light, they cannot even transmit unimpaired that which they receive. That anything further could be derived from human skill in the construction of instruments, the labors of his illustrious predecessors, and his own, left the son of Herschel no reason to hope. Huygens, Fontana, Gregory, Newton, Hadley, Bird, Short, Dolland, Herschel, and many others, all practical opticians, had resorted to every material in any wise adapted to the composition either of lenses or reflectors, and had exhausted every law of vision which study had developed and demonstrated. In the construction of his last amazing specula. Sir John Herschel had selected the most approved amalgams that the advanced stage of metallic chemistry had combined; and had watched their growing brightness under the hands of the artificer with more anxious hope than ever lover watched the eye of his mistress; and he had nothing further to expect than they had accomplished. He had the satisfaction to know that if he could leap astride a cannon ball, and travel upon its wings of fury for the respectable period of several millions of years, he would not obtain a more enlarged view of the distant stars than he could now possess in a few minutes of time; and that it would require an ultra-railroad speed of fifty miles and hour, for nearly the live-long year, to secure him a more favorable inspection of the gentle luminary of night.

The interesting question, however, whether this light of the solemn forest, of the treeless desert, and of the deep blue ocean as it rolls; whether this object of the lonely turret, of the uplifted eye on the deserted

battle-field, and all of the pilgrims of love and hope, of misery and despair, that have journeyed over the hills and valleys of this earth, through all the eras of its unwritten history to those of its present voluminous record; the exciting question, whether this "observed" of all the sons of men, from the days of Eden to those of Edinburgh, be inhabited by beings like ourselves, of consciousness and curiosity, was left for solution to the benevolent index of natural analogy, or to the severe tradition that it is tenanted only by the hoary solitaire whom the criminal code of the nursery had banished thither for collecting fuel on the Sabbath-day.

The limits of discovery in the planetary bodies, and in this one especially, thus seemed to be immutably fixed; and no expectation was elevated for a period of several years. But, about three years ago, in the course of a conversational discussion with Sir David Brewster upon the merits of some ingenious suggestions by the latter, in his article on optics in the Edinburgh Encyclopedia (p. 644), for improvements in the Newtonian Reflectors, Sir John Herschel adverted to the convenient simplicity of the old astronomical telescopes that were without tubes, and the object-glass of which, placed upon a high pole, three its focal image to a distance of 150, and even 200 feet. Dr. Brewster readily admitted that a tube was not necessary, provided the focal image were conveyed into a dark apartment, and there properly received by reflectors. Sir John then said that, if his father's great telescope, the tube alone of which, though former of the lightest suitable materials, weighed 3,000 pounds, possessed an easy and steady mobility with its heavy observatory attached, an observatory moveable without the incumbrance of such a tube, was obviously practical. This also was admitted, and the conversation became directed to that all-invincible enemy. The paucity of light in powerful magnifiers.

After a few moments silent thought, Sir John diffidently inquired whether it would not be possible to effect a transfusion of artificial light through the focal object of vision! Sir David somewhat startled at the originality of the idea, paused awhile, and then hesitatingly referred to the refrangibility of rays, and the angle of incidence. Sir John, grown more confident, adduced the example of the Newtonian Reflector, in which the refrangibility was corrected by the second speculum, and the angle of incidence restored by the third. And," continued he, "why cannot the illuminated microscope, say the hydro-oxygen, be applied to render distinct, and, if necessary, even to magnify the focal object?" Sir David sprang from his chair in the ecstasy of conviction, and leaping half-way to the ceiling, exclaimed, "Thou art the man!" Each philosopher anticipated the other in presenting the prompt illustration that if the rays of the hydro-oxygen microscope, passed through a drop of water containing the larvae of a gnat and other objects invisible to the naked eye, rendered them not only keenly but firmly magnified to dimensions of many feet; so could the same artificial light, passed through the faintest focal object of a telescope, both distinctify (to coin a new word for an extraordinary occasion) and magnify its feeblest component members. The only apparent desideratum was a recipient for the focal image which should transfer it, without refranging it, to the surface on which it was to be viewed under the revivifying light of the microscopic reflectors. In the various experiments made during the few following weeks, the co-operative philosophers decided that a medium of the

purest plate glass (which it is said they obtained, by consent, be it observed, from the shop window of Mons. Desanges, the jeweller to his ex-majesty Charles X, in High street) was the most eligible they could discover. It answered perfectly with a telescope which magnified 100 times, and a microscope of about thrice that power.

Sir John Herschel then conceived the stupendous facric of his present telescope. The power of his father's instrument would still leave his distant from his favorite planet nearly forty miles, and he resolved to attempt a greater magnifier. Money, the wings of science as the sinews of war, seemed the only requisite, and even the acquisition of this, which is often more difficult than the task of Sisyphus, he determined to achieve. Fully sanctioned by the high optical authority of Sir David Brewster, he laid his plan before the Royal Society, and particularly directed it to the attention of His Royal Highness the Duke of Sussex, the ever munificent patron of science and the arts. It was immediately nd enthusiastically approved by the committee chosen to investigate it, and the chairman, who was the Royal President, subscribed his name for a contribution of œ10,000, with a promise that he would zealously submit the proposed instrument as a fit object for the patronage of the privy purse. He did so without delay, and his Majesty, on being informed that the estimated cost was œ70,000, naively inquired if the costly instrument would conduce to any improvement in navigation? On being informed that it undoubtedly would, the sailor King promised a carte blanche for the amount which might be required.

Sir John Herschel had submitted his plans and calculations in adaptation to an object-glass of twenty-four feet in diameter: just six times the size of his venerable father's. For casting this ponderous mass, he selected the large glass-house of Messrs. Hartly and Grant, (the brother of our invaluable friend Dr. Grant) at Dumbarton. The material chosen was an amalgamation of two parts of the best crown with one of flint glass, the use of which, in separate lenses, constituted the great achromatic discovery of Dolland. It had been found, however, by accurate experiments, that the amalgam would as completely triumph over every impediment, both from refrangibility and discoloration, as the separate lenses. Five furnaces of the metal, carefully collected from productions of the manufactory, in both the kinds of glass, and known to be respectively of nearly perfect homogenous quality, were united, by one grand conductor, to the mould; and on the third of January, 1833, the first cast was effected. After cooling eight days, the mould was opened,a nd the glass found to be greatly flawed within eighteen inches of the centre. Nothwithstanding this failure, a new glass was more carefully cast on the 27th of the same month, which upon being opened during the first week of February, was found to be immaculately perfect, with the exception of two slight flaws so near the line of its circumference that they would be covered by the copper ring in which it was designed to be enclosed.

The weight of this ponderous lens was 14,826 lbs. or nearly seven tons after being polished; and its estimated magnifying power 42,000 times. It was therefore presumed ot be capable of representing objects in our lunar satellite of little more than eighteen inches in diameter, providing its focal image of them could be rendered distinct by the transfusion of article light. It was not, however, upon the mere illuminating power of the hydro-oxygen microscope, as

applied to the focal pictures of this lens, that the younger Herschel depended for the realization of his ambitious theories and hopes. He calculated largely upon the almost unlimited applicability of this instrument as a second magnifier, which would supersede the use, and infinitely transcend the powers of the highest magnifiers in reflecting telescopes.

So sanguinely indeed did he calculate upon the advantages of this splendid alliance, that he expressed confidence in his ultimate ability to study even the entomology of the moon, in case she contained insects upon her surface. Having witnessed the completion of this great lens, and its safe transportation to the metropolis, his next care was the construction of a suitable microscope, and of the mechanical frame-work for the horizontal and vertical action of the whole. His plans in every branch of his undertaking having been intensely studied, even to their minutest details, were easily nd rapidly executed. He awaited only the appointed period at which he was to convey his magnificent apparatus to its destination.

[To be continued.]