REVIEW OF HERSCHEL'S OUTLINES OF ASTRONOMY: FROM THE CHRISTIAN EXAMINER FOR SEPTEMBER 1849

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REVIEW.

Outlines of Astronomy. By Sir John F. W. Herschel. London. 1849. pp. 661.

It is unfortunately too often the case, that those who have attained to high culture in any department of knowledge find it irksome to clothe their thoughts in a popular form, and to communicate in ordinary language with the public. This arises in part from the difficulty of expressing themselves in common words with that nicety to which they are accustomed and which their habit of mind demands; but still more from the fact, that the talents and taste which stimulate to original researches are seldom found combined with the rhetorical acquirements which are necessary to fix the attention of differently constituted minds. For the teacher, a certain diffuseness is indispensable. His vocation requires him, as Fichte says, "not to communicate his idea as the author does, abstractly and in the one perfect conception under which it presents itself to his own mind, — but he must mould, express, and clothe it in an endless variety of forms, so as to bring it home, under some one of these garbs, to those by whose present state of culture he must be guided in the exercise of his calling. And, above all, he must possess the creative or artistic talent of the scholar."

In consequence of this repugnance to diffuse knowledge on the part of those whose calling it is to increase it, the second class of scholars has arisen, — the class who receive from the original discoverer and distribute to their fellowmen. Their profession is in itself a noble one, because without it the first would labor without benefit to their race; but, in consequence of their lower degree of culture, much error becomes intermixed with the knowledge they diffuse, in the very process of distribution.

When, therefore, a scientist, of high attainments, an original investigator, devotes himself with earnestness to the work of adapting to popular comprehension his own hard-earned knowledge, his labors are entitled to the most respectful consideration, and, if they answer their purpose, will be sure of the gratitude of the community.

It was with high gratification that we received, some time since, the announcement of a new popular work on astronomy, by Sir John Herschel. His reputation for versatility of talent and elegance of scholarship, and his past labors in astronomy and photography, have gained for him an enviable position; and, unlike most men of equal eminence, he has striven to diffuse the knowledge which he has labored to increase. If there be any one from whom the public would be warranted in anticipating a thorough, accurate, and elegant popular work on astronomy, in the English language, it is Sir John Herschel. The "Discourse on the Study of Natural Philosophy" was published fifteen or twenty years ago; and the author, occupying as he does a distinguished position among European astronomers, and possessing the authority of a doubly illustrious name, has unquestionably exerted, through this book, a highly beneficial influence upon the public mind.

In April last, the work appeared, whose title stands at the head of this article, — a work which professes to be an extension of the "Treatise on Astronomy," formerly published. The author says that the "Treatise" has been revised and remodeled, and much new matter introduced; that the parts relating to the lunar and planetary perturbations have been rewritten upon a far more matured and comprehensive plan; and that those on sidereal and nebular astronomy have been brought up to the present state of our knowledge.

We have carefully read the book, and do not hesitate to say that we are disappointed. The mechanical execution is beautiful; the text is comparatively free from typographical errors; the plates and maps are finely engraved; and the appearance of the volume must make an agreeable impression. But throughout the work, or, at least, throughout the new parts of it, the indications of inaccuracy are too numerous to allow us to place implicit confidence in any statement before verifying it.

Of the style we do not propose to speak. It may suffice to say that it is very unequal. While some passages are exquisitely beautiful and interesting, or thrillingly eloquent,

others are so obscure as to be almost unintelligible. A single example will illustrate our meaning: —

"Now, though we cannot see the path of a star in the heavens, we can wait till the star itself crosses the field of view, and seize the moment of its passage to place the intersection of its wires so that the star shall traverse it; by which, when the telescope is well clamped, we equally well secure the position of its diurnal circle as if we continued to see it ever so long." — p. 99.

Some of the expressions rivet the reader's attention, and compel his admiration by their felicity and singular aptitude, while others seem, at least to an American ear, almost pedantic, as when the author speaks (p. 388) of "the *orthogonal* [? perpendicular] component of the disturbing force," or says (p. 405) that it is impossible to give any idea of "the analytical conduct" of Lagrange. We notice that Sir John uses Dr. Whewell's word "thermotics." Why not "thermics"? And, if the word *optics*, in the sense of the science of light, be discarded, "photics" would seem more convenient than "photology," and quite as conformable to established analogy.

The introduction is reprinted with but slight change from the former work. It is a beautiful chapter, clear and concise, informing beginners in astronomy what they have a right to expect from an elementary work on this science.

"Its utmost pretension," says Herschel, "is to place them on the threshold of this particular wing of the temple of Science, or rather on an eminence exterior to it, whence they may obtain something like a general notion of its structure; or, at most, to give those, who may wish to enter, a ground-plan of its accesses, and put them in possession of the password. Admission to its sanctuary, and to the privileges and feelings of a votary, is only to be gained by one means, — *sound and sufficient knowledge of mathematics, the great instrument of all exact inquiry, without which no man can ever make such advances in this or any other of the higher departments of science, as can entitle him to form an independent opinion on any subject of discussion within their range.* It is not without an effort that those who possess this knowledge can communicate on such subjects with those who do not, and adapt their language and their illustrations to the necessities of such an intercourse. Propositions which to the one are almost identical are theorems of import and difficulty to the other; nor is their evidence presented in the same way to the mind of each."

The book is divided into four parts. The first comprises more than half the volume, and treats of spherical astronomy,

astronomical instruments, and the bodies of our solar system; the second is devoted to the theory of planetary perturbations; the third is on sidereal astronomy; and in the last, which consists of but a single chapter, is a description of the several ways of keeping account of time, and of the different calendars.

The first few chapters are occupied with general ideas and elementary conceptions, terminology, and the like. Although these would naturally demand a place at the commencement of a popular work, and although they are elaborately given, yet we much doubt whether, as they stand, they will be of any service to beginners, unless perhaps these chapters may answer as a dictionary of technical terms. We say this on account of the obscurity which they would present to the class of readers for whom the book is designed. Statements of simple propositions are made in technical language, and enveloped with a shroud of symbolic letters; which, however clear to those accustomed to mathematical studies, are still in no wise attractive to the general reader. For instance, in the note to p. 55, speaking of the relative motion of two bodies, he says: —

"If two bodies, A and B, be in motion independently of each other, the motion which B, seen from A, would appear to have if A were at rest, is the same with that which it would appear to have, A being in motion, if, in addition to its own motion, a motion equal to A's, and in the same direction, were communicated to it."

This proposition seems to us indeed to require "more thought for its clear apprehension than can perhaps be expected from a beginner," more, indeed, than should be demanded of any one for the comprehension of so simple an idea. We believe that its meaning is merely, — that the real motion of a body (which is seen from another moving one) is the resultant of its apparent motion and that of the observer.

An anecdote is related upon page 20, in connection with the remarks on the "dip of the horizon." "The history of aëronautic adventure" is said to "afford a curious illustration" of this principle. A celebrated aëronaut, by the name of Sadler, descended in his balloon nearly to the surface of the sea, after sunset; but, throwing out his ballast, suddenly rose again to a great height, and enjoyed "the whole phenomenon of a western sunrise." On descending again, he saw the sun set a second time. It is somewhat remarkable, that, in the course of his long Atlantic voyages, the author had

never availed himself of a means of enjoying the same curious illustration, without any expenditure of gas. The masts and rigging of a ship furnish all the necessary apparatus, as every sailor, and almost every passenger, knows. It is by no means an unusual thing for an observer at the mast-head, or even at the crosstrees, to witness a sunrise, and then, descending rapidly, enjoy what the author would call the whole phenomenon of an eastern sunset.

A page or two farther on, the height of the atmosphere and of clouds is discussed. Sir John there states that "it seems probable, from many indications, that the greatest height at which visible clouds *ever exist* does not exceed ten miles; at which height the density of the air is about an eighth part of what it is at the level of the sea." In a report to the French Academy, concerning the voyage of the frigate Venus in the Atlantic Ocean and South Sea, the commander, Admiral Du Petit Thouars, names as the maximum of the observed height of clouds, fourteen hundred meters.* Kaemtz, however, in his Treatise on Meteorology, (i. 384,) states, that, on one occasion, a cloud was observed at the height of sixty-five hundred meters. This would give a maximum height of about four miles. We cannot, therefore, but cordially agree with Herschel that their greatest height probably never does exceed ten miles.

It is an interesting question at what height the specific gravity of the atmosphere would permit visible vapor to remain suspended. The density of air at the height of ten miles would correspond to a barometric pressure of one hundred and two millimeters, — about four inches.

The chapter upon astronomical instruments and observations will probably be useful to the beginner; although, as we should expect, English instruments are described rather than continental ones, and the student is referred to Dr. Pearson's Astronomy. The standard of precision is a corresponding one; — as when we read (on the same page) that "in good transit observations, an error of *two or three tenths of a second of time* in the moment of a star's culmination is the utmost which need be apprehended, exclusive of the error of the clock." Should this meet the eye of any of the German or Russian astronomers, they will be indeed amazed at the degree of precision which may be obtained!

We were somewhat surprised on reading the note at the bottom of the 103d page. Sir John Herschel there says: —

* A mile is a little more than 1609 meters.

"By a peculiar and delicate manipulation and management of the setting, bisection, and reading off of the circle, aided by the use of a movable horizontal micrometric wire in the focus of the object-glass, it is found practicable to observe a slow-moving star (as the pole-star) *on one and the same night*, both by reflection and direct vision, sufficiently near to either culmination to give the horizontal point, without risking the change of refraction in twenty-four hours; so that this source of error is completely eliminated."

Although the author seems to have been unaware of many of the refinements introduced into the continental observations, it is astonishing that he should not have known that it has been for many years the usage at Greenwich to observe not merely the slow-moving, but also the equatorial stars, at the same transit, both by reflection and by direct vision; — the star being directly observed over one half the threads, and the telescope then quickly pointed to the reflected image, by means of an index-level previously set for this purpose.

The method of determining the zero point of an altitude circle, by reflection of the cross-threads of the telescope from the surface of mercury, is erroneously ascribed in page 108 to Benzenberg. Astronomy is indebted to Bohnenberger for this beautiful and accurate process, by which the telescope is "made its own collimator."

Still more strange is the manner in which the author entirely omits any mention of the name of Thomas Godfrey, of Philadelphia, "the inventor," as Dr. Franklin said long since, "of what is called Hadley's sextant." In the American Magazine for the months of July and August, 1758, and in the Notes to the first volume of Dr. Miller's "Retrospect of the Eighteenth Century," are a series of letters which prove, beyond the possibility of doubt, the independent invention of the instrument by Godfrey in 1730, prior to any publication by Hadley upon the subject. It is there shown how the knowledge of the invention could have reached Mr. Hadley; and letters are published, written by both Logan and Godfrey to Dr. Halley, at that time Astronomer Royal of England. The date of these letters was 1732. Two years later, Mr. Logan publicly stated that he had transmitted his letter to Halley in May of that year. "I must own," said he, "that I could not but wonder that our good-will was never acknowledged. I did not then, nor do I now, assume any other merit than this in either of Godfrey's instruments. I only wished that the ingenious inventor himself might by some means be taken notice of, in a manner that might be of real