

THURSDAY, NOVEMBER 14, 1895.

## THE EVOLUTION OF THE COSMOS.

*Notes on the Nebular Theory in relation to Stellar, Solar, Planetary, Cometary and Geological Phenomena.*

By William Ford Stanley, F.R.A.S., F.G.S., &c.  
(London: Kegan Paul, Trench, Trübner, and Co., Limited, 1895.)

THE object of the present treatise is to establish in a modified form the nebular theory of Laplace, by the introduction of some original views which have long occupied the attention of the author. This is an ambitious scheme, and it is a little disquieting to read that authorities whose opinions carry weight did not recommend the communication of these views to the learned societies, whose duty it would have been to weigh and consider them. The reason assigned is, that the views were thought to be too speculative; and after studying them with great attention, we have no hesitation in saying that we hold the advice to have been sound.

Undoubtedly the nebular hypothesis as enunciated by Laplace is on its trial, and does not recommend itself unreservedly to those most capable of judging its merits. It may be admitted that a new working hypothesis would demand and receive great attention. But emendations, to be accepted, must come from those who have made a profound study of mathematical and physical science, and have proved themselves men of original genius. It may be that Mr. Stanley has qualified himself to speak with authority on this difficult subject, and undoubtedly the many references quoted in his volume display considerable reading and research; but the references are too frequently, not to original sources, but to the more popular writings and expositions to be found in the *Proceedings* of the Royal Institution, or in the pages of *Good Words* or the *English Mechanic*, and these authorities are quoted, apparently with as much satisfaction as the *Philosophical Transactions*. It is impossible to resist the impression that the author's scientific information is second-hand. The literary style of the work does nothing to remove this impression, and is incompatible with a complete mastery over the subject. Clearness of expression is wanting; obscure passages, that tax the patience of the reader, abound, and occasionally we come across sentences that defy interpretation altogether. As an example of these latter, we may give the following (p. 42):—"Assuming the pneuma to be a most perfect fluid and elastic system of matter, upon the meeting of two volumes of such matter, independently of any initial rotation it might possess, must have moved under pressure at the meeting plane in every or any direction, which at the time offered the least resistance to the continuity of its initial momentum." Obscurities such as these may possibly prevent the presentation of the author's views exactly as he would have wished. There are many statements which we cannot accept, if we have properly understood them, but which, expressed differently, might command a ready assent.

At the outset of his work, Mr. Stanley gives an historical account of the distinguishing features of the main cosmical theories, which have been elaborated by great

minds in the past. The author's want of grasp and poverty of description are in this first chapter most conspicuous. Instead of a full and lucid account of these earlier ideas, which one would naturally expect in a work of this character, the reader must be content to find very meagre and obscure notes on the theories of Descartes, of Kant, of Laplace, or of more modern authorities, as Helmholtz, or of Faye. From this point onward to the end of the book, the author devotes himself to the description of his own views and theories. It has always been admitted, hitherto, by scientific men, that nothing more than a partial solution of the problem presented by the origin of the universe can possibly ever be expected, and, certainly, that our present state of knowledge is inadequate to the task. Laplace, for instance, based his hypothesis on the assumed existence of the sun, and sought to prove no more than the possibility of the formation of a system of planets, such as we see in existence. Mr. Stanley's theories are far more ambitious. Not only does he seek to account for a state of things existing prior to, and leading up to the formation of the sun, but he undertakes to explain such details as geological periods and the disposition of the materials of the earth's crust.

Following the theory which was first suggested by Wright of Durham, that the Milky Way forms one vast originally connected system, Mr. Stanley imagines immense districts in space filled with matter in its "original state." This is assumed to be of an attenuated gaseous character, and since the calculated size of the ultimate atom would leave less than a single specimen to the cubic metre, each one, for reasons which are not apparent, is divided into a large number of parts called "pneumites," which in a state of perfect atomic dissociation give rise to every line in the spectrum of light. The form of the "pneumites" is described in detail; but, inasmuch as our knowledge of the ultimate nature of the atom itself is confessedly imperfect, these speculations are obviously useless from a scientific point of view.

Having formed these arbitrary notions of the elementary condition of matter, existing at a high temperature, Mr. Stanley proceeds to explain the origin of the Milky Way as a vast agglomeration of pneumites, to which he gives the name "pneuma," moving in slow rotation. To account for the flattened form of the Galaxy, it is suggested that two such spheroidal "pneumas" drifted together at an early period, forming at their common surface a somewhat denser plane, over which the more distant parts of the pneumas would spread themselves by the action of their original momenta, while such parts as did not entirely combine would cause an apparent bifurcation. The division of this original "pneuma" system into nebulae, and ultimately stellar systems, appears to be left to no more dignified cause than chance, aided by condensations brought about by heat radiation. The means by which it is suggested that these bodies kept distinct can only be described as obscure and unsatisfactory, and the attempt to cover with a false appearance of reasoning what must, by the nature of the case, remain matter for the vaguest speculation and assumption, is altogether to be regretted.

The author proceeds to discuss the behaviour of one of these separate condensations which is taken as the

origin of the solar system. It is limited in every direction by the surface at which particles are in equilibrium under the influence of gravity of the solar nebula itself, and of the nearest stellar systems. Under the pressure of the outer portions, a centre of greater density would be formed, to which would be attracted all the matter in the inner parts of the nebula. The outer parts, on the other hand, condensing by radiation, as it is suggested, into comets and meteorites, will not reach the vicinity of the solar nucleus until a much later period, depending on their distances. Some of these will fall into and augment the nebulous sun, while others will become permanent members of the solar system. It is typical of the author's method that either event is left entirely to chance, and it is difficult to see where a line is to be drawn between the sun-forming matter and that which evades the nebulous envelope of the central attracting body. The abrupt disruption of the nebula, thus introduced, offers a most perplexing difficulty.

The process by which the planets come into existence presents precisely the question, to which an answer would be expected in the book before us. It must be said at once that the portion of the book dealing with this question is most unsatisfactory. In addition to the obscurity of style, to which allusion has already been made, the unfortunate arrangement of the subject-matter makes it quite impossible to gain any clear insight into the author's views as a connected whole. Mr. Stanley appears to adopt the theory of Laplace in its main features, not because he has any novel arguments to urge in its support, nor on account of the reasons which have hitherto led to its tentative acceptance, but because, in his opinion, no other theory heretofore offered possesses any reasonable probability. "Nevertheless," he says (p. 65), "it is not probable that our system was formed by any simple single mechanical effect of the action of forces upon surrounding universal matter, as generally assumed in special theories, but rather that all possible conditions were active, that may have conspired to produce the final results." Thus, for example, according to the theory of Laplace, the author thinks there should be a simple relation connecting the masses of the planets with their respective distances from the sun. He therefore attempts to explain the irregularities observed in the masses of the planets, by supposing them to be caused by the precipitation into the solar nebula of that matter, which at a much earlier period condensed by itself at the outermost parts of the solar "pneuma." Such a process implying the previous formation of masses, of variable amount, and operating irregularly and intermittently, may account for the existence of planets greatly differing in size; but, at the best, the difficulty is only removed from one place to another. It seems equally impossible to agree with the author that the plane in which the planets revolve, has been determined by the superior attraction of the two nearest stars. For both this plane and the equatorial plane of the sun should apparently preserve the direction impressed by the moment of momentum of the original solar nebula.

Space will not permit us to follow further Mr. Stanley's notions of the processes of planetary evolution or the effects which, it is suggested, the successive formation of

planets had upon geological periods. It can only be said that the author toys with millions of years in a manner which possibly amused himself, but which can scarcely be edifying to the serious student. Unless the leading points of Laplace's theory can be placed practically beyond question, the consideration of details can have no scientific interest. And Mr. Stanley could hardly expect to rescue from its present position of doubt, and to place on a secure basis a theory, on the merits of which the ablest mathematicians and physicists have been unable to arrive at a definite conclusion. We have already intimated our opinion that the author's knowledge of mathematics and physics is slight. In confirmation of this view, we might draw attention to his treatment of the problem of finding the volume of a ring (p. 82), and to a bold assertion, on p. 190, concerning the increase of vapour tension in the atmosphere. We might, too, point to his contemptuous rejection of the theory, well supported by the highest authority, that the interior of the earth is not fluid. He is also singularly unhappy in refusing to accept Prof. G. Darwin's demonstration, that the earth formerly rotated at a much higher velocity than at present, because the study of the effects of tidal friction has always appeared to give direct evidence in favour of the probability of the nebular hypothesis.

W. E. P.

#### ELEMENTARY HIEROGLYPHICS.

*First Steps in Egyptian: a Book for Beginners.* By E. A. Wallis Budge, Litt.D., Keeper of the Egyptian and Assyrian Antiquities, British Museum. (London: Kegan Paul, Trench, Trübner, and Co., 1895.)

A REVIEW of a book dealing with the laws and structure of language may perhaps at first sight appear out of place in a journal devoted to science. A moment's consideration, however, will convince the reader that the book, the title of which stands at the head of this column, may be regarded as an exception to the rule. Very little was known of ancient Egypt until, at the beginning of the present century, the genius of Young and of Champollion led to the decipherment of the native inscriptions. Since that time, however, Egyptology has attracted many workers, and to the results that have followed the first decipherment the student of anthropology is perhaps even more indebted than the philologist; for while the language in itself proved unattractive in consequence of its somewhat chaotic structure, the subject-matter revealed was of the very highest importance. The key to the hieroglyphics, in fact, admitted the anthropologist and man of science to the study of the legends and beliefs, the daily life and customs of a people, whose history commences more than four thousand years before our era.

The truth of this statement is confirmed by the immense mass of literature that has within the last few years grown up around the records and remains of ancient Egypt. The man of science has made good use of his rich vein of fresh material, histories have followed quickly on one another's heels, while many of the Egyptian sacred texts and legends have appeared from time to time in the form of short stories and translations; in fact, the public has been amply provided with the means for acquiring a general knowledge of Egypt.