

## THE EVOLUTION OF THE WORLDS.\*

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I have felt considerable difficulty in preparing a suitable paper for presentation to the Ottawa Field-Naturalists' Club. The connection between natural history and astronomy is so slight that no subject was known to me, forming a sufficient connecting link between the two sciences, to base a paper upon. It was only upon learning that it was not essential for the paper to have any direct relation with the natural sciences that I undertook to prepare it. Although it is almost entirely astronomical in character yet the title suggests some analogy to one of the most important developments in your science, that of evolution. I hope to be able to trace for you, if only in an imperfect way, how the development of the celestial universe has taken place, and I think we will find as we go along, that there is in some respects considerable similarity in the scheme of evolution in the two sciences.

Although we, in our feeble way, can trace the process of development from the original primal material in its simplest forms to the very complex manifestations that we see all around us, both on the earth and in the heavens, and can see that this development in both sciences has followed by the operations of laws, which, simple in themselves, are yet so perfect and complete and far reaching as to excite our admiration and awe, yet we have in the very beginning to start with the Creator. Surely there is not one of us but feels that such a plan of creation as is here implied requires a higher, wider, and nobler conception of the Almighty Ruler of the Universe than the one which imagines it to have been made, as it were, in a moment.

It is only within comparatively recent years that we have been able to enunciate any definite theories in regard to the constitution and mode of formation of the universe and its component parts, in which is included, as a very insignificant portion, our own solar system. Undoubtedly the one discovery leading to this advance was that of the principles of spectrum analysis, first definitely enunciated by Kirchoff in 1859. On this epoch-making discovery is based the whole science of astrophysics, sometimes called the new astronomy, which treats of the constitution of the heavenly bodies, as apart from their positions and motions in the celestial sphere, which is the province of the older astronomy, or astrometry as it is now sometimes called.

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