the crashing together of defunct suns--the smashing of the greater part of each into nebulous dust surrounding the remainder, which will form an intensely heated nucleus --then, possibly, the formation of a new and larger set of planets, with a proportionately larger and hotter sun--a solar system on a far grander scale than the present. And so on, growing in grandeur, but diminishing in number, till the exhaustion of energy is complete, and after that, eternal rest, so far at least as visible motion is concerned."*

From such conclusions as to the future, certain other conclusions follow as to the far remote past. It has been conjectured as probable that the nebula from which our own solar system has been formed was produced by a previous collision of two great sidereal bodies, the violent crashing together of which, generating heat faster than it could be dispersed by radiation, converted it into motion of expansion, and so generated a nebula of magnificent dimensions from which our solar system was gradually formed as already described. And as all matter appears to be in a condition of gradual coalescence, so not only our solar system, but all the conceivable material universe, must once, so far as we can judge from known laws of nature, have been in an almost infinitely rarefied condition. As the authors of "The Unseen Universe " say : "Our modern knowledge enables us to look back with almost certitude to the time when there was nothing but gravitating matter and its potential energy through the expanse of space, ready, as slight local differences of distribution predisposed it, to break up into portions, each converging to one or more nuclei of its own, and thus forming in time separate solar or stellar systems. We have thus reached the beginning as well as the end of the present visible universe, and have come to the conclusion that it began in time, and will in time come to an end. Immortality is therefore impossible in such a universe.

Our authors, however, do not leave us to the contemplation of so dismal a spectacle as this dead, dark, frozen corpse of a mate-

rial universe, destitute of all energy, life, or movement, actual or potential. By a most ingenious hypothesis they dispose of this huge wreck, standing like a burnt-out volcano-a reminder of activities which shall be no more. The hypothesis by which they transfer the lifeless relics of the "visible universe" back to the region of the invisible, is founded upon the curious and profound speculations of Helmholtz and Clifford as to the ultimate composition of what we call "matter," and the hypothesis called the "vortex-atom" theory. What this thing is which we call "matter," which appears under such an infinite variety of aspects, has long been a puzzle to physicists. It is believed that the smallest divisible portions of any particular kind of matter, which we call molecules, ultimately consist of indivisible and indestructible atoms. But, atoms of what? What is this universal homogeneous substratum underlying so many different forms and textures ? In Sir William Thomson's hypothesis, matter as well as heat is simply motion, and the atom is nothing but a ring of vortex motion existing in a perfect fluid. "Vortex-motion" might be defined as the motion of a ring of liquid, every portion of which ring is in a state of rotary motion round its own axis. Professor Clifford illustrates it by describing a ring of indiarubber receiving a rotatory motion from having the stick on which it was stretched pulled through it while it was kept in its place on the stick. Another illustration is the smoke-ring that comes from a smoker's In Professor Clifford's words, "The lips. outside of the ring is kept back by the friction of his lips, while the inside is going forwards; thus a rotation is set up all round the smoke-ring as it travels out into the air. Helmholtz found by a wonderfully beautiful calculation that in a perfect liquid, where there is no friction, it is impossible for vortex-motion to be generated or destroyed; in any part of the liquid where there is no vortex-motion, no mechanical action can possibly start it; but where it once exists, there it is for ever, and no mechanical action can possibly stop it. A vortex-ring may move from place to place, but it carries with it the liquid of which it is composed, never leaving any particle behind, and never taking up any particle from the surrounding If we tried to cut it through with a liquid. knife, it would thin out like a stream of

^{*}Such a prediction irresistibly suggests the wonderful words of the Hebrew poet, long ages before any of these physical speculations were thought of: "Yea, all of them [the heavens] shall wax old like a garment; as a vesture shalt thou change them, and they shall be changed."