

receive energy, where does it come from? if we lose energy, where does it go to?" It was recognised that the great store of energy on which we at present depend is the heat of the sun, which is partly used or wasted by daily radiation, partly stored in the separated energies of chemical substances, such as were produced by the agency of solar heat in bygone ages; the deposits of coal in the bowels of the earth being a prominent and important example. Where does the heat of the sun come from, and how is it maintained? These were some of the questions which began to be asked. The genesis of the cosmos, as suggested by Laplace and fancifully elaborated by popular writers, had taken note only of the matter in the sun and in the planetary system, and had disregarded the heat¹ or energy which the sun supplied, and on which the historical changes on the surface of our globe have almost entirely depended. "But physical laws are for our mental vision," as Helmholtz says, "like telescopes which penetrate into the farthest night of the past and the future."² Shortly before the pioneers of the mechanical theory of heat published their

¹ "When Playfair (in his 'Illustrations of the Huttonian Theory') spoke of the planetary bodies as being perpetual in their motion, did it not occur to him to ask, What about the sun's heat? Is the sun a miraculous body ordered to give out heat and to shine for ever?" (Lord Kelvin in 1868, "On Geological Time," 'Popular Lectures and Addresses,' vol. ii. p. 45.) "The old nebular hypothesis supposes the solar system and other similar systems through the universe which we see at a distance as stars to have originated in the con-

densation of fiery nebulous matter. This hypothesis was invented before the discovery of thermodynamics, or the nebulae would not have been supposed to be fiery; and the idea seems never to have occurred to any of its inventors or early supporters that the matter, the condensation of which they supposed to constitute the sun and stars, could have been other than fiery in the beginning" (id., 1871, *ibid.*, vol. i. p. 184).

² See 'Vorträge und Reden,' 3 Aufl., vol. i. p. 57.