

the gathering up of cosmical matter which, under the force of gravitation, was in rapid motion—so the heat of the sun originated through the conversion of the energy of this arrested motion into heat. This process of gathering up of cosmical or meteoric matter is still going on, and it makes up for the loss or expenditure of solar heat through radiation. Helmholtz, in the sequel of his investigation into the conservation of energy, likewise takes up this problem, and while admitting to some extent Mayer's theory,<sup>1</sup> shows that even without the accession of cosmical matter, the mere contraction through gravitation of the gaseous substances of the sun would result in a continual production of heat. His calculations show that the amount of this contraction, resulting in a diminution of the sun's apparent diameter, would not be great enough to be perceptible during historic ages. The theory of Helmholtz has in general been accepted as

which the sun's heat was kept up by breakfasting and dining on meteorites. (See Wolf, 'Handbuch der Astronomie,' vol. ii. p. 433.) It is on the other side equally interesting to see how Herbert Spencer, for whom the nebular hypothesis was a principal example of cosmic evolution, failed to avail himself of the strengthening support it received through thermodynamics (see 'Essays,' vol. i., "On the Nebular Hypothesis," 1858). Had Mayer brought his ideas into connection with Laplace's cosmogony, he probably would have hit upon the correcter version, the contraction theory, which it was reserved for Helmholtz to propound in 1854.

<sup>1</sup> The subject was about the same time taken up by William Thomson (Lord Kelvin), first in a paper "On

the Mechanical Energies of the Solar System" (Trans. Edin. Roy. Soc., 1854), and continued in a series of papers and addresses, reprinted in his mathematical, &c., papers (vol. ii.) in the 1st volume of his 'Popular Addresses,' and in an appendix to Thomson and Tait's 'Natural Philosophy.' He shows that the form of the meteoric theory propounded by Mayer, and independently by Waterston (Brit. Assoc., 1853), is as little able to explain the maintenance of the sun's heat through known historic ages as the chemical theory of combustion, which was already abandoned by Mayer in 1846, and finally adopts Helmholtz's form of the meteoric theory as the most likely. ('Pop. Lect.,' vol. i. p. 365, &c.; p. 373, &c.)