

and Bunsen's spectrum analysis, so in the closely related doctrine of heat, probably no publication did more to establish a general kinetic view of matter and of natural phenomena than Tyndall's celebrated treatise, 'Heat as a Mode of Motion.' In spite of the criticisms which have been levelled against this expression,<sup>1</sup> the book, which appeared in 1863, was to the popular mind a revelation; it was translated into many foreign languages, ran through many editions, was recommended by thinkers of the first order, and the title coveted as "manifesting far and wide through the world one of the greatest discoveries of modern philosophy."<sup>2</sup> It is the popular herald of the kinetic or mechanical view of nature.

38.  
Tyndall's  
'Heat.'

The same great authority who has so generously referred to Tyndall's treatise—Lord Kelvin—had been inspired from quite a different quarter to suggest the most advanced conception, in this line of thought, of which the human mind has so far been capable: the

39.  
Lord  
Kelvin's  
vortex  
theory of  
matter.

<sup>1</sup> Notably by Prof. P. G. Tait; see his volume on 'Heat,' p. 350, also his 'Recent Advances of Physical Science,' which contains as an appendix his lecture on "Force," delivered in Glasgow on the occasion of the meeting of the British Association. He says there: "Heat and kinetic energy in general are no more *modes of motion* than potential energy of every kind is a *mode of rest*." "Heat is not the mere motions, but the energy of these motions." There is no doubt that the terms force and motion can be used in very different meanings, and that the early expounders of the mechanical theory of heat have not been always consistent in the use of words; though their ideas, wherever they appeared in mathematical

expressions, were definite enough. A good deal of vagueness has accordingly crept into popular textbooks and into philosophical treatises, and criticisms such as those of Prof. Tait have been useful in helping us towards clearer conceptions. We shall come across more of these instances in the next chapter when dealing with the gradual evolution of the conception of energy.

<sup>2</sup> See Lord Kelvin's abstract of lecture, "Elasticity viewed as possibly a Mode of Motion," 1881; 'Popular Lectures,' &c., vol. i. p. 142. "I have always admired it" (viz., Tyndall's title); "I have long coveted it for elasticity, and now, by kind permission of its inventor, I have borrowed it for this discourse."