

foremost intellects are still busy in working this to them promising vein of reasoning.¹

The opponents of the kinetic, mechanical, or material views of natural phenomena have always existed: in the early years of the century they described their view by the word "dynamic." At that time it was the atomic theory they principally objected to. But their criticisms, though not without use in exposing the limited nature of all mechanical explanations, failed to yield any fruits, inasmuch as they moved in vague expressions and did not lend themselves to that powerful method by which alone the conquest of nature has been effected, viz., mathematical reasoning, combined with observation.

The more recent critics of the mechanical interpretation of physical phenomena, among whom I will only mention Prof. Ostwald of Leipzig, Prof. G. Helm of Dresden, and Prof. Ernst Mach of Vienna,² are fully

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Criticism of
mechanical
view.

¹ "With reference to the vortex-atom theory, I do not know of any phenomenon which is manifestly incapable of being explained by it; and personally I generally endeavour (often without success) to picture to myself some kind of vortex-ring mechanism to account for the phenomenon with which I am dealing. . . . I regard the vortex-atom explanation as the goal at which to aim," &c. (Prof. J. J. Thomson, quoted *ibid.*)

² Prof. Ernst Mach is the earliest of these writers and had worked on quite independent lines before the other two names began to figure in scientific literature. His criticisms refer both to metaphysical and mechanical theories. His position is original and unique, and his writings, which are a splendid example of critical and historical

analysis, have been invaluable to me. His earliest important essays date from the year 1872 ('Die Geschichte und die Wurzel des Satzes von der Erhaltung der Arbeit,' and 'Die Gestalten der Flüssigkeiten,' Prag). They are now generally accessible, having been collected and translated (under the title 'Scientific Lectures,' Chicago, 1895) by Prof. T. J. M'Cormack. His 'Science of Mechanics' (translated by the same author from the second German edition, London and Chicago, 1893) has, ever since its first appearance in 1883, had a great influence in Germany; and latterly also in this country, as may be seen from such works as Prof. Karl Pearson's 'Grammar of Science' (1st ed., 1892, p. 387), and notably from Prof. Love's 'Dynamics' (p. 85).