

modes of action, without the intervention of a material connection between the two ; the other class, on the contrary, maintains that this is impossible and inconceivable, and endeavours, from the hypothesis of a material connection, to show that the observed laws necessarily follow from the essential properties of matter.

These theories are known respectively as the doctrines of action at a distance, and action by contact.

In order to compare these theories, it will be necessary to fix upon some possible arrangement of the universe to which both classes of thinkers may yield assent, and then decide upon the merits of each of the above doctrines by applying them in explanation of natural phenomena, or by testing their consistency with inductions from natural phenomena other than the laws of attraction and repulsion.

Imagine then material bodies to consist of very minute indivisible particles of continuous matter, separated by minute intervals of space ; also, suppose that all these bodies are surrounded and saturated, so to speak, with a highly elastic medium of extreme tenuity, which itself consists of much more minute particles of matter, separated by empty spaces. The first-mentioned matter corresponds to what may be called gross matter ; the second, to the luminiferous ether. It is true that there is a conception of the constitution of matter which at first sight may seem to be different from the above, and which of late years has found great acceptance, viz., the notion that an atom is a vortex ring in a frictionless fluid ; but the arrangement above assumed may include this, as the vortex atoms, if such there be, may be constructed out of the assumed material.

In accordance with the theory of action at a distance, the above particles of matter all act on each other by means of certain attractions and repulsions with which they are indued, and also by collision.

In the action by contact theory, the various attractions, repulsions, elasticities, &c., are referred solely to the motions of the particles, and their collisions. The touchstone by which we intend to test the rival theories, is the principle of the conservation of energy. It is true that observation has not completely established the truth of this principle as a law of nature, but the conviction of its truth is becoming stronger day by day as our observations increase ; and no theory of the constitution and modes of action (or forces) of matter can be considered as likely to be true, which can be shown to be inconsistent with this principle.