Newton versus Einstein: How Matter Interacts with Matter. Peter Graneau and Neal Graneau. Affiliated East–West Press Pvt Ltd, 104, Nirmal Town, 26, Barakhamba Road, New Delhi 110 001. Carlton Press, Inc. 1993. 219 pp. Price: 95.00

This book deals with the subject of matter–matter interaction controversy in a non-mathematical language and, according to its authors, 'is intended for readers who are fascinated by the laws of nature'. It presupposes only a modest knowledge of physics at the high school level. There are, till date, broadly two matter interaction principles – contact action and action at a distance. Every object, in the words of Aristotle, is pushed, pulled, carried, or twirled by whatever was in contact with it. Therefore, if a body moved, something else must have provided the driving force and stayed in contact with it. On the other hand, Newton's law of gravitational attraction of two masses is based on the action at a distance concept, since no matter how far the masses are, the inverse square law of gravitational attraction gives the instantaneous force between them. The concept of evolution of Newton's action at a distance starting from Aristotle's idea of matter touching matter (contact action) for causing interaction is described lucidly and characterizes the entire book. The next milestone in the evolution of matter interaction concept is of Maxwell who introduced the concept of fields as the carrier of interaction. As the authors have stated, it is the field contact action which replaced the ordinary contact action. Maxwell introduced the luminiferous ether medium which coexists with the Newtonian action at a distance. This ether was capable of sustaining mechanical stresses. Attraction between distant bodies could be replaced by ether tension. The ether stresses of Maxwell took the place of Coulomb far-action. There was another set of ether stress to replace far action between current elements to take care of magnetic interactions. The modern concept of matter interaction is due to Einstein who demolished Maxwell's ether tension. Einstein insisted on retaining local field-contact action and rejected the action at a distance. The authors have made a remarkable and penetrating analysis of the history of ideas lying behind the Newtonian and Einsteinian philosophy of matter interaction.

The authors profess their belief in the Newtonian action at a distance mode of interaction on the basis of some of their own experiments. They believe in the Ampere's action at a distance law between two current elements and not in the standard Magnetic Lorentz force law. The authors explain the principal difference between the two laws as follows: When the two current elements lie on a straight line and point in the same direction, Ampere's law claims that the elements repel each other, while the Lorentz law denies the presence of any interaction force. Hence if the two laws are applied to the same metallic current circuit, Ampere's law predicts certain internal tension forces in the wire. The authors mention of more than a dozen experiments, some discussed separately in the book *Ampere-Neumann Electrodynamics* (Hadronic Press, Palm Harbor FL, 1985) by the senior author, reveal Amperean tension in wires. A few crucial experiments have been discussed. One such experiment, originally performed by the Polish scientist Nasilowski and repeated later by the authors, is the observation of fracture of aluminium rods of 1 m length and 1.2 mm diameter in which large impulsive currents were passed. Close examination of the fractured faces revealed no trace of local melting, but favoured explanation invoking Amperean tension. The authors claim the Lorentz force law cannot explain this phenomenon. Another experiment described by the authors was to stack cylindrical copper blocks of 1/4-inch diameter and 2 cm long in a close-fitting vertical glass tube. The entire stack was compressed by a spring at one end. Under large current pulses, these blocks were seen to separate from one another by small distances and short electric arcs were seen between the blocks. This observation, according to the authors, can only be understood by the longitudinal Amperean forces. Yet another experiment described in the book uses half-inch-square copper rods, each one foot long, glued flush into a groove in a pexiglass board, leaving a one-foot channel section between the rod ends. This 1/2-inch square trough of one-foot length was filled to the top with liquid mercury. Thus they had a 3-foot long, half-inch square, copper–mercury–copper conductor in a groove of a plastic board. When a current of 300 amperes was passed through this conductor assembly, a wave pattern formed on the top surface of mercury. According to the authors, these are manifestation of longitudinal mercury flow just below the surface of mercury. Again this phenomenon is a pointer to the Amperean longitudinal force. These and other similar experimental results reported in the book and the explanation given by the authors [all of which are published in respectable international journals such as *Nature*, *Physics Letters*, *Journal of Applied Physics*, the Ph D thesis (University of Nottingham, 1962) of the senior author, etc.] are thought provoking. But no technical details are given in the book since the nature of the book has not allowed the authors to enter into these aspects. The purpose of the book is, perhaps, to arouse curiosity in the minds of readers having technical background and to guide them to the original published research articles. I believe that the standard Maxwell–Lorentz theory of electrodynamics is capable of proper explanation of the reported findings. I further believe that the majority of working physicists would hold the same view on the explanation of these experiments. They would probably have no patience reading and swallowing the authors viewpoints after a brief perusal of the book. Surely the authors have anticipated this kind of reaction. Apparently, an earlier reviewer of the manuscript of this book has written (to quote the authors): 'Nowadays, the Church is not much of a threat to freedom of expression in science. But the Academy is a terrific threat – and in no academic sense.' The straightforward style of the authors in presenting facts is a noteworthy feature of the book.

Perhaps, the most prominent attempt to formulate a direct particle action at a distance theory of matter interaction is that of Fred Hoyle and J. V. Narlikar (*Action at a Distance in Physics and Cosmology*, W. H. Freeman and Co., San Francisco). I am disappointed to find no mention of this work which is very pertinent to the ideas discussed. I regard this as a serious shortcoming of the book. The discussion on the nonlocality aspect of quantum mechanics is not up-to-date as of 1993 (the year of publication of the book). An appendix to the book stating the Ampere's law in its mathematical form and a more detailed treatment of at least one of the author's experiments would have added to the value of the book.

In spite of shortcomings, I find the book very interesting and informative. It would be of value to physicists interested in foundations of field physics. Also to those who believe that the direction taken by the authors is a retrograde step, it offers challenge to find consistent explanations of the experiments reported in the cited papers within the present day conventional physics.

The get-up of this reasonably priced paperback is good.

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Science for a Polite Society (Gender, Culture and the Demonstration of Enlightenment). Westview Press Inc., 5500 Central Avenue 391, Boulder, Colorado, 80301-2877, USA. 1995. Price: $35. 391 pp.

The book is about the Science of Scientific Revolution during the seventeenth and the eighteenth century France. It presents social and cultural history of the birth of new Science during the reign of Louis XIII, XIV and XV. It explains in detail about the 'intellectual community' who practised what they usually called 'natural philosophy' and 'natural history', and throws light on the influence, with respect to the literary and cultural context, of the new Science developed by them on the polite Society. The book, as the title suggests, depicts the gentle attributes of natural philosophy in the seventeenth and the eighteenth century Paris. These attributes proved to be crucial to the way in which the field entered into the intellectual world. The book explains how social elite in Paris accepted Science as valid and interesting. French accepted Science as the basis for their enlightenment because of their personal fascination with the philosophy of nature and the history of its creatures. It is the larger faith in the philosophy of the natural world, a kind of widely based movement in elite culture that is being presented.

The book proceeds with what the author calls a standard story of steady and rational progress of Science, according to which the birth of new Science represented the discovery of immutable truths about the nature. It begins with the astronomical system of Nicholos Copernicus who in his book *De Revolutionibus* (On the Revolution of heavenly bodies) published in the mid-sixteenth century, produced a mathematical model for the motion of planets around the stationary sun. Following his mathematical framework for heavenly bodies, a generation of natural philosophers like Galileo Galilei, Kepler, Rene Descartes and Francis Bacon came into limelight, who with their observational skills and mathematical elegance of their theories, gave alternatives to the cumbersome Christianized Aristotlian world-view. This lead to a continuous and unified progress in Science with a large school of experimentalists doing systematic investigation of the natural phenomena by inventing more and more sophisticated instruments, and also some gifted mathematicians formulating their corresponding mathematical models. During the last decades of seventeenth century 'incomparable' Isaac Newton in his *Principia* provided three universal laws applicable to both terrestrial as well as heavenly bodies. Newton's work was followed by a host of mathematicians working out the details and the applications of his theories.

According to the standard story, the eighteenth century consolidated the advances of the seventeenth century. The new Science became popular because it provided a source of amusement and spectacle through demonstration-cum-lectures, (and also through their proceedings published (and distributed) weekly by some special Institutions, e.g. 'Bureau d'Adresse' run by Renaudot in Louis XIII France). According to the author, the interest in Science arose not from some patriotic duty or self-imposed discipline but rather from sheer enjoyment that the practice of Science brought to its amateurs. With the triumph of science came a sort of intellectual prestige that made it a model of what rationality should be. The enlightenment of the eighteenth century took scientific thought as the basis of human progress. The scientific community believed that the application of the methods and techniques of scientific theory could reform political and economic thought.

I shall now discuss some of the aspects incorporated by the author in his book which make it different from other traditional accounts of the history of Science. The author has presented the kind and gentle face of Science in the Ages of Reason and Enlightenment.. which is more feminine than is usually highlighted by the standard historians of Science. The author has discussed in some detail the significant role played by women in the acceptance of new Science by a polite society, or in other words, the feminine or the feminist side of the Scientific Revolution has been explored. The influence of women, especially, during the reign of Louis XIV and the early period of the rule Louis XV, on who practised science and how they practised it has been described.. Their involvement ranged from the serious study of Mlle de Chetaignaires or Mme du Chatelet, the academy of Mme de Guedreville to simple attendence at the Rohault's or Nollet's lectures or the reading of Fontenelle's *Conversations on the Plurality of Worlds.* Even though, in general, women were not the permanent members of 'academic' institutions like 'Academie royale des science', the author draws attention to their active participation in essentially every philosophical or experimental venue, giving suggestions on how to make science more amusing, fascinating as well as enlightening. This aspect which proved crucial in popularizing Science, is not in general discussed in standard literature on history of Science.

The author has described in detail about the work of intellectuals ranging from Renaudot, Descartes, Chapelain, Huygens, etc. to Nollet, Leibniz and Newton. He has also discussed the famous disputes among the Cartesians, Newtonians and Leibnizians. The competing theories came to be accepted either at the demonstration lectures or in some academic institutions, e.g. the reconciliation between Cartesians and Newtonians became explicit at Mme du Chatelet's 'Institutions de physique'. This in turn, according to the author, represents the feminine side rather than masculine side of the Scientific Revolution.

The demonstration lectures which proved crucial in making the new Science popular have been explained in detail which helps the reader to get a 'feel' for the nature of these demonstrations and their impact on the general audience. The author describes the demonstration lectures (with pictures of