

## BOOKS RECEIVED

### SUMMARIES AND COMMENTS

*Tomasz Komendziński*

ACHINSTEIN, Peter: *Particles and Waves. Historical Essays in the Philosophy of Science*, Oxford University Press 1991, 337p.

This is a very important book for the history and philosophy of science. Achinstein's essays discuss methodological issues generated by three historical episodes in nineteenth-century physics: the wave-particle debate about the nature of light, the development of James Clerk Maxwell's first „particle” theory of gases, and J. J. Thomson's discovery that cathode rays are particles, not waves (p. 3).

This book consists of three parts: Theories of Light: Particles versus Waves, Maxwell and the Kinetic Theory of Gases and Cathode Rays and the Electron. In the first part Achinstein's essays analyze Newton's general methodological position regarding „hypotheses”, the methodology actually practiced by nineteenth-century wave and particles theorists and the philosophical basis for the dispute between John Stuart Mill and William Whewell. In the second part Achinstein discusses a number of Maxwell's methodological views about the postulation of unobservables. By appeal to Maxwell's practice Achinstein argues that the method of hypothesis is correct, even if other claims it makes are questionable. The principal role of a derivation of Maxwell's distribution law for molecular velocities is discussed in essay 6 in this part. In the third part Achinstein considers J.J. Thomson's postulation of the electron as a result of a series of experiments. The methodological question raised concerns the relationship between the particle theory of cathode rays defended by Thomson and the experiments he performed to support the theory (p. 5). The methodological question related to Thomson's postulation of the electron is a special case of the general question: How are theories postulating unobservable entities related to the experiments to which they lead and that are alleged to confirm them? Achinstein defends „a series of theses about this relationship and draws conclusions

78 concerning the hypothetico-deductive method as well as standard philosophical theories about what constitute scientific evidence for hypotheses about unobservables” (p. 5).

One of Achinstein's most important contributions is his description and reconstruction of a strategy frequently employed to argue for theories invoking „unobservables”. The strategy contains both an explanatory part and what Achinstein call „independent warrant” (some form of inductive or causal-inductive reasoning). „This is a philosophical work that treats methodological issues generated in actual scientific episodes-issues that influenced the participants and

concerning which they often held views of their own. Each episode involves the postulation of unobservable entities, and each raises general philosophical questions of interest to contemporary as well as past thinkers concerning what scientific method is appropriate in such cases". Achinstein's aim is „to present the history as well as the philosophy in sufficient depth to make the result enlightening to philosophers and historians of science as well as to others who relish methodological pursuits" (p. 8). It is brilliant ideas which are realized in Achinstein's book perfectly.

AGAZZI, Evandro, CORDERO, Alberto, eds. *Philosophy and the Origin and Evolution of the Universe*, Kluwer Academic Publishers 1991, 466 p.

It contains selected papers from an international colloquium held in Lima in August 1989, as the annual meeting of the International Academy of Philosophy of Science related to natural sciences and their philosophy. „Science and philosophy are therefore deeply interrelated, at the moment where man tries to understand the Universe and his place in it". Contemporary cosmology tries to consider the Universe as a whole and to propose theories regarding its origin and evolution. Cosmology as science are again interrelated with philosophical issues concerning the epistemological status and presuppositions as well as the real sense and interpretation of the theories. This book consists of thirteen essays and general introduction by Agazzi and Cordero.

Regarding „The Universe as a Scientific and Philosophical Problem" Evandro Agazzi „tries to show how the investigations of contemporary cosmology vindicate the intellectual interest of a classical philosophical problem [...], encouraging a renewed dialogue between science and philosophy" (p. X—XI). Agazzi analyzes the significance of scientific cosmology, cosmology and the model of science, the hermeneutic dimension of cosmology, how cosmology avails itself of physical theories, the testability of cosmological theories, the *a priori* assumptions of cosmology, time in cosmology, the philosophical features of cosmology, and boundaries with metaphysics. Agazzi argue that „with the development of cosmology, contemporary science has

again found many links with philosophy, which seemed to have been discarded for more than a century” (p. 43).

Roberto Torretti’s „The Geometric Structure of the Universe” is intended to provide a necessary conceptual background for the fuller view of present-day physical cosmology. Torretti presents conceptions of Albert Einstein, Willem de Sitter and Alexander Friedmann.

Barton Zwiebach in his more technical essay „Superstring Unification and the Existence of Gravity” considers superstring theory as a novel and promising framework for a unified theory of all physical phenomena and for the unification of all forces of nature.

In next essay (long — p. 87-202!) „The Universe of Modern Science and its Philosophical Exploration” Dudley Shapere returns to relation between science and philosophy. Shapere analyzes science as object and framework of philosophical inquiry, the Universe of contemporary science, problems of the modern scientific picture. He presents also the search for higher unification and considers the future of the contemporary scientific picture.

The molecular view taken by Robert Engel (chemist) in „From Molecules to Life” provides a different perspective of the nature of „living systems” and of the phenomenon of „life” than either a physicist or a biologist. Technical analysis continues Christopher Cherniak’s „Meta-Neuroanatomy: The Myth of the Unbounded Mind/Brain”. Cherniak considers neuroanatomical issues at the level of philosophy and methodology.

A bridge towards more philosophical considerations is represented by the papers of Mariano Artigas „Emergence and Reduction in Morphogenetic Theories” and of Jesus Mosterin „What Can We Know About the Universe?” Artigas argue that „the origin of the universe and mankind are the two limiting cases within the evolutionary worldview, whose main task consists in providing morphogenetic theories that may explain how new levels emerge out of other more basic ones” (p. 253). Because of that problems about emergence and reduction occupy a central place in Artigas essay. Mosterin maintains that the word „universe” can be used in at least 4 different senses: the perceptible universe, the observable universe, the intelligible (or theoretical or conceptual) universe, and the ultimate universe (or the whole of reality) (p. 263—289). Mosterin presents universe in the 4 senses and discusses limits of any.

Mosterin’s consideration continues Massimo Pauri in essay on „The Universe as a Scientific Object”. Pauri argue that Universe as a whole cannot be considered as a scientific object in any sense and argue that „is no justification for relativistic cosmology’s claim that it has given or is about to give empirical answers to the traditional „cosmological problems” (whether the Universe is boundless or not, what its age and destiny may be, how it came about, and so on)” (p. 291).

The epistemological problems related to contemporary cosmology are discussed in the following two papers: „General Laws of Nature and the Uniqueness of the Universe” by Erhard Scheibe and „The Anthropic Principle and its Epistemological Status in Modern Physical Cosmology” by Bernulf Kantitscheider. Kantitscheider considers the different options in the formulation of the Anthropic Principle as well as Alberto Cordero in „Evolutionary Ideas and Contemporary Naturalism” analyzes the recent trends in philosophy of science and naturalism as a contemporary philosophy.

In the final chapter „Origin and Evolution of the Universe and Mankind” Francisco Miro Quesada discusses the general thematic of the book.

Agazzi’s and Cordero’s collection does not have the pretension of illustrating problematic of philosophy and the origin and evolution of the Universe in full. But the problems presented in the book are some very important.

BARROW, John D.: *The World within the World*, Oxford University Press 1988, 398 p.

This is a very interesting book to philosophers and scientists. Barrow analyzes the new ideas in a serious but non-technical style within a historical context. This book gives the opportunity to follow the evolving concept of laws of Nature from the magical notions to the latest scientific ideas. It is a picture of transition from simply experience of the world to knowledge about the world. Barrow argues that „the practice of science also rests upon a number of presuppositions about the nature of reality” (p. 24). His most obvious presuppositions are following: 1) There exists an external world which is external to our minds, and which is the unique source of all our sensations, 2) This external world is ultimately rational, 3) The world can be analysed locally without destroying its essential structure, 4) The elementary entities do not possess what we call freewill, 5) The separation of events from our perception of them is a harmless simplification, 6) Nature possesses regularities, and these are predictable in some sense, 7) Space and time exist, 8) The world can be described by mathematics and 9) These presuppositions hold in an identical fashion everywhere and everywhen.

Barrow adopts the presuppositions as guiding principles in the fascinating investigations of the answers to the following questions: Are there really laws of Nature that exist out there independently of our way of thinking waiting to be discovered, or are they just the most convenient way of describing things that we have been able to write down? Are these natural laws the same everywhere? Are there places where they cease to hold? Can they change with time? Indeed, is it possible that there aren’t really any laws of Nature at all? Why is its language of mathematics found to offer us such a ready translation of the Universe’s

workings? What are the implications of our own existence for our interpretation of the Universe's structure? Do we have the intellectual capability to understand the deepest principles behind the harmony and complexity of Nature?

BECHLER, Zev: *Newton's Physics and the Conceptual Structure of the Scientific Revolution*, Kluwer Academic Publishers 1991, 588p.

This book consists of three parts: Tradition (chapters: Aristotelian and Platonic Conceptions of Explanation, Aristotle's Philosophy of Nature and Theory of Potentiality, Plato's Concept of the Actual and his Philosophy of Nature), The Logical Revolution (chapters: The Copernican Harmony, Bacon's Informative Logic, Informativity and Paradox: Galileo's Conception of the Nature of Physical Reality, Descartes' Informative Logic), Newton's Physics and its Critics (chapters: Newton's Logic of Space and Time, Absolute Motion and the Nature of Inertial Forces, Modern Newtonian Historiography and the Puzzle of Newton's Absolute Space, Locke and the Meaning of „Empiricism“, Newton's Invention of the Problem of Induction, Circularity and Newton's Philosophy of Nature, Leibniz's Aristotelian Philosophy of Nature, Berkeley's Aristotelian Critique of Newton's Physics).

Bechler presents the historiographic picture of of the historic subject matter related to the scientific revolution in the 17th century. He argues that conceptual structure of the scientific revolution is platonic and argues against aristotelism in the historiographic tradition and presently accepted picture of the scientific revolution. The terms platonic and aristotelian which Bechler introduces in chapter 1, 2 and 3 are not strictly historical. In the first chapter Bechler explains „the difference between these systems of physics by a difference in the *informational structure*, and [...] argues that the essential feature of the scientific revolution lies in its ideal of *informative explanation*" (p. 5). Aristotelian philosophy of nature is based on the need for rationality and it leads to a non-informational conception of explanation. Platonic philosophy of nature is based on the informational conception of explanation and is basically irrational. Bechler's book is very important work to consideration in the history and philosophy of science presenting the new interpretation of the scientific revolution in the 17th century's scientific thought and discussing detailed analysis of Galileo, Descartes and Newton's physics (and Newton's critics by Leibniz and Berkeley as aristotelian reaction).