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Book Review

History of Science, Philosophy and Culture in Indian Civilization

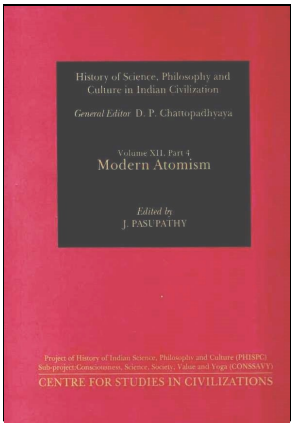
J. Pasupathy (ed.)

Volume XII, Part 4: Modern Atomism

Centre for Studies in Civilizations (CSC)
DD-16, Kalkaji, New Delhi 110 019. 2017
xxxv + 585 pages
Price: not mentioned.

This volume is one in the mega series brought out by the Centre for Studies in Civilizations, New Delhi, under the general editorship of D. P. Chattopadhyaya, an eminent professor of Philosophy and founder Chairman of the Indian Council of Philosophical Research. In the general introduction to this series, Chattopadhyaya mentions: 'The aim of this project is to discover the main aspects of Indian culture and present them in an interrelated way.' The reviewer knows of the following science and India-related volumes, science being considered an integral part of culture and being a real component of the project: 'India in the world of physics; then and now', 'Science in India', and 'Science and modern India: an institutional history'. That the present volume on 'modern atomism' is a part of this series is a tribute to the depth and breadth of the undertaking. The editor, J. Pasupathy, who spent his professional life mostly in the Indian Institute of Science, Bengaluru, begins by stating in the Preface, 'The collection of articles in this volume deals with the following questions: Which are the fundamental particles with which our universe is made? What are the laws that govern their dynamics? What is "space" and what is "time"?' This interpretation of modern atomism, and consequent thematic emphasis have resulted in the above book of nearly 600 quarto-sized pages.

The book emphasizes, overwhelmingly, subatomic particles and the basics of quantum mechanics, relativity, symmetry, astrophysics and cosmology. As a result, there are a number of capable but somewhat disjointed reviews in this broad area. These are, with a few exceptions, accessible to non-specialist professional physicists, since many ideas and phenomena expected to be familiar to them are assumed. The project itself addresses a wide audience, I believe. The articles vary greatly in their literal detail and communication effort. For example, I found the one on 'Evolution from classical to quantum theory' (R. Parthasarathy and J. Pasupathy) useful in its careful description of some details of the 'new' quantum mechanics. 'The story of the neutrino' (G. Rajasekharan) is readable. The article on 'The standard model of particle interactions' by Palash Pal, though somewhat technical, is well written. However, many contributions are patchily put together, and seem frozen in time, both in their point of view and content. For example, there is not much mention of the Higgs boson and its possibly momentous role in physics (the article by Pal mentions briefly the possibility of the Higgs boson, discovered in 2012; the book was published in 2017). Ideas such as broken symmetry, emergence and topological



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quantum field theory are not discussed. Some of the articles included do not seem to be connected with the stated theme of the book, e.g. 'Satellite based astronomy' and 'Collaboration in experimental research'. I feel that strong editorial effort at presenting a cogent story was needed.

The fact that modern atomism is interpreted this way, and that so much effort has been put into its presentation by a large number of capable scientists, seems a tale of missed opportunity. Twentieth century science experienced the reality of atoms and its ubiquitous consequences; the Indian role in this and its connection (if any) with traditional Indian atomism, have not been brought out. I briefly touch on these now. The centrality of atoms is widely appreciated, though the exciting inward-bound journey into the subatomic world of 'fundamental' particles continues. As the great physicist Richard Feynman (quoted also in this book) said, 'If all scientific knowledge were lost in a cataclysm, what single statement would preserve the most information for the next generation of creatures? I believe it is the atomic hypothesis that "all things are made of atoms – little particles that move around in perpetual motion...". The knowledge behind such a statement underlies almost all of modern physics, chemistry and biology. Two examples in physics are: all quantum condensed matter physics, including spectacular manifestations of quantum effects on macro scale as in super-conductors, and modern atomic physics with its direct impact on quantum information technology. There is no mention of the foundations of modern chemistry which are atomistic, except for a good first article on pre-twentieth atomistic premonitions in chemistry (S. Ramasesha). Molecular biology gets a few lines. This century also saw not only the consequences of atoms which are a purely quantum reality; with the scanning tunnelling microscope, discovered in 1981, one could 'see' atoms. Their sizes were measured in many ways. A number of Indian scientists who had a role in modern atomism are mentioned in the book. However, it is not clear from the brief write-ups appended as to what their role was. For example, what was the role of the Raman effect in the establishment of modern atomism? What is the atomistic meaning of Ramachandran plots? I missed the name of E. C. G. Sudarshan, who proposed the V-A theory of the weak force, a crucial contribution to subatomic physics. Much farther afield, two proponents of traditional Indian know-how (Annie Besant and George Leadbetter) used a yogic siddhi called 'anima' acquired by them over decades of practice in India, and claimed that the proton consists of three quarks, nearly half a century before the experimental discovery of the quark constitution of the proton (this is not modern science, but could mark an intriguing connection between other ways of knowing, and modern atomism).

In summary, I think that this book is not an appropriate representative of modern atomism in the Indian context, and as such does not sit comfortably in the array of volumes detailing science, philosophy and civilization in the Indian context. However, it contains, a number of good reviews of facets of subatomism as it developed in physics, till the last quarter of the 20th century.

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