

RECENT ADVANCES
in
RELATIVITY THEORY



Volume 1
Formal Interpretations

M.C. Duffy & M. Wegener
eds.

Hadronic Press

RECENT ADVANCES
in
RELATIVITY THEORY

SELECTED PAPERS

*From the Biennial Conferences on
Physical Interpretations of Relativity Theory
(1988-1996)*

*The conferences were sponsored by the
British Society for the Philosophy of Science
and held at the Imperial College, London.*

Volume One: Formal Interpretations
*Edited by M.C. Duffy and M.T. Wegener
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M.C. Escher: *Relativity*.**

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Volume 2
Material Interpretations

M.C. Duffy & M. Wegener
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PREFACE

The title given to this selection, *Recent Advances in Relativity Theory*, derives from a suggestion originally made to the academic committee by one of its members, Prof. F. Selleri. Of course, this could not have been the title given to a series of conferences: one cannot decide, but only hope, that a planned series of scientific conferences will issue in theoretical advances. In retrospect, however, one may get a feeling that the hope has not been entirely in vain.

So, by adopting the proposed title instead of the original title of the conferences

Physical Interpretations of Relativity Theory

the editors wanted to hint at the fact that the present selection of papers, which covers the years 1988-1996, in their opinion offers more than mere interpretations, or re-interpretations, of an entrenched theory of modern physics, namely that of Relativity. Indeed, already the attempt to convene not only a single meeting but a whole series of meetings focussing on this topic was a strong signal that the one and only initiator and organiser of these meetings, Dr. M.C. Duffy of the University of Sunderland, did not see the subject as closed nor the usual conclusions as final. It demands courage to send such a signal to the establishment, and it presupposes both a strong health, a great administrative talent and a large measure of diplomacy to realize such an attempt. I believe that I speak on behalf of all participants in these meetings when I say that their success, the extent of which is yet to be judged by the readers of this volume as well as the one to follow, is due almost entirely to a single person: Michael Ciaran Duffy.

The present volume, together with the one in preparation, comprises 2×30 papers of approximately 2×280 pp. Considering this amount to be too much for a single volume, it was decided to split it up into two. Realizing that it was problematic to organize all papers according to their subject-matter, an alphabetic order was chosen for each volume. Finding it awkward to let the two volumes be distinguished by an arbitrary letter, say *Q*, an attempt was made to suggest a preliminary separation of thematic priorities by distinguishing the contents of the volumes according to the kind of interpretation favoured by the papers. So we chose to settle on a very rough division of the papers according to whether they - *prima facie* - represent what might be called *formal interpretations* (vol.1) or what might be called *material interpretations* (vol.2). Proceeding thus, a certain affinity to the original title of the meetings was preserved.

In place of an explicit organization of the material - which seems almost predestined to become "one-dimensional" - it would be possible to suggest various strategies of reading. However, in order not to impose my own views upon the reader I prefer not to be too explicit. But that much should be said: It appears that the papers of Ghosal & Chakraborty, Jennison, Kostro, Kroes, Øhrstrøm, Sjödin, Sklar, Tonkinson, and Törnebohm, constitute an important group treating crucial aspects of the formal structure of relativity theory (no priority intended). The papers of Barrett, Comte, Paparodopoulos, and Prokhovnik, place the theory of relativity firmly within a cosmological context. Advanced mathematical possibilities are investigated by Roscoe, Santilli, and Tavakol. Central metaphysical issues are discussed by Craig and Mercier. The inclusion of purely philosophical papers is justified by the sponsorship of *BSPS*.

Mogens Wegener

INTRODUCTION

This volume contains papers written by participants in the *Physical Interpretations of Relativity Theory* conferences, sponsored by the British Society for the Philosophy of Science. The meetings, which are biennial, took place in the years 1988-1996 and are still continued; they were organised from the School of Engineering and Advanced Technology, Sunderland Polytechnic, now School of Computing, Engineering & Technology, University of Sunderland. The majority of the papers selected for inclusion in this volume were read at Imperial College, London, by their authors; but in some instances the authors were not able to read their paper at location, and their work was included in the conference proceedings as "supplementary papers". The present volume contains a first selection, and it is intended to issue others in the future.

The original objective of the meetings was to review the various interpretations of the mathematical formal structure of relativity theory, and to examine the models, analogues, and second interpretations, with which the mathematical formulations are sometimes accompanied. Relativistic ether theories and models, which interpret the accepted formal structure of relativity were included as themes fit for review. The relationship between current expositions of relativity and previous expositions, as e.g. the Poincaré-Lorentz or the Einstein-Minkowski expressions, was examined in meeting sections dealing with historical and philosophical aspects of physics. Experience gained through the meetings so far held has justified the impression that history and philosophy deepen insight into the various interpretations of the formal structure of relativity.

The use of the word "physical" in the title of the meetings implied no adverse criticism of the general prevalence of mathematical and geometrical formulations in 20th century physics. It indicated that the meetings were organised to review not only geometrised and mathematical expositions, but physical models of various kinds and experimental technique and equipment. They were also intended to review the range of meanings ascribed to the term "physical", as compared to "geometrical" or "mathematical". In order to do this, the programs were organised to bring together mathematicians, physicists, engineers, historians and philosophers in the hope that the work of each would disclose fresh and fruitful insights to colleagues working in other disciplines. The meetings fully demonstrated that much is to be gained from cross-fertilisation between those disciplines in which expertise in, and respect for, relativity theory are found.

A broad approach was taken, and papers were accepted dealing with the relationship between relativity and other basic fields in physics, such as quantum theory and cosmology. Whether or not the papers concentrated on mathematical, philosophical, experimental or other issues, the objective was to deepen insight into relativity, to provide a comprehensive review of contemporary issues, and so assist in the solution of outstanding problems. It cannot be claimed that traditional areas of dispute have been entirely removed. The controversies concerning ether formulations of relativity, the relative advantages and disadvantages of the Poincaré-Lorentz or the Einstein-Minkowski expositions, the ever-recurring discussions of the clock-paradox, and the criticisms of particular expressions of the relativity principle, have not been terminated. Nevertheless, the organisers hope that progress has been made towards bringing the several parties forward towards a fuller understanding of each other's position.

The conference objectives have remained substantially unchanged. The main objective was, and is, to explore the advantages, or disadvantages, of the various physical, mathematical and geometrical interpretations of the formal structure of relativity; to review differences of opinion concerning them; and to clarify them by calling on a range of disciplines including history, philosophy and epistemology, as well as the obvious disciplines within physical science. Permanent sections of the program include relativistic aspects of gravitation, cosmology, and space-time structure, as well as the nature of *vacuum*. Specialist sections were devoted to time, the reference frame, present-day relativistic ether theories and models, and to the relationship between physical, mathematical and geometrical concepts. The section devoted to consider the experimental aspects of relativity turned out to be particularly fruitful.

The organisers encouraged free discussion and criticism in a rational scientific spirit. The scope of the meetings was predicated on the accuracy and excellence of the principles and formal structure of relativity, special and general. They were organised to examine aspects of the various interpretations of this formal structure, including history, philosophy, methodology, in addition to technical and conceptual detail. Criticism of established opinion and theory was, of course, admitted - but it was decided to exclude papers of a polemical nature, particularly those written in an anti-Einstein, and anti-relativity spirit.

The papers selected for this first volume have been chosen in part to reflect the wide range of themes covered by the meetings and thereby to indicate the many aspects of relativity related to the interpretation of the established mathematical formal structure.

Considerable assistance was given by Sunderland Engineering Education Development Service, and School of Mechanical and Manufacturing Engineering, University of Sunderland, which provided facilities and funding to launch the conferences in 1988. Through the successive reorganisations of the engineering departments, resulting in the current School of Computing, Engineering and Technology, valuable assistance, support, and facilities, were provided which contributed greatly to the success of the conferences.

Valuable publicity for the meetings was provided by the Europhysical Society, the Fondation Louis de Broglie; London Mathematical Society; Royal Astronomical Society; Institute of Mathematics and its Applications; Institute of Physics; British Journal for Philosophy of Science; Foundations of Physics; General Relativity and Gravitation; International Journal of Theoretical Physics, and American Institute of Physics.

Prof. M. Wegener must be honoured for his outstanding contribution to the publication of the present selection of papers. In every way he has been the chief editor, and he has been the prime mover in contacting authors, liaising with the publishers, editing the scripts, and preparing the collected papers in standard format.

Special thanks are also due to Prof. G.H. Keswani, Dr. P. Rowlands and Dr. M. Surdin for their kind advice and assistance by selecting and refereeing the papers.

Finally, I want to express my gratitude to the Institute for Basic Research, Florida, and its director, Prof. R.M. Santilli, for their generous offer to publish this selection.

Michael C. Duffy

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To
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Date: February 11, 1999

Dear Prof. Wegener

Subject: Manuscript - *The Concept of Lorentz Invariant Clocks*

Please find enclosed the corrected manuscript entitled "*The Concept of Lorentz Invariant Clocks*" by P. Chakraborty and myself.

I once again appreciate your thoughtful editing of our paper. The presentation could not have been better. So kind of you! Apart from some typographical errors, that I have indicated on the copy by pencil mark I have nothing to say about your corrections and language.

However I would like to add a paragraph under a new heading ACKNOWLEDGMENTS the following :

The authors are indebted to Professor M. Wegener of the University of Aarhus, Denmark for his contribution towards improvement of the manuscript. One of the authors (SKG) would also like to thank Professor M. C. Duffy for his kind invitation to take part in the PIRT conference held at Imperial College, London.

I would like to further suggest that the name and address part in the first page (after the title) be changed a little. You may consider using a smaller font if you are constrained to accommodate this in one line. The suggested changes are written by pencil on the copy. I also enclose a page containing a list of suggested corrections. Thanks.

With Kindest regards,
Yours sincerely

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1st February 1999.

Dear Prof. Wegener,

Many thanks for sending the proofs of my contribution to the Book.

I thought that I had responded some time ago but things have been a bit hectic here and I must have forgotten! Your rendering of the paper deserves the fullest praise. I have only spotted one minor spelling error - on the second page, third paragraph, third line - "propper" should read "proper".

I regret that I never had the pleasure of knowing Milne in person.

I have only had time to glance at your very interesting 1996 paper, but I hope to have the opportunity to read it properly when I return my 103 year old mother-in-law to the north of Scotland in a couple of weeks.

With very best wishes,

Yours sincerely,



Afsendelsesdato: **Fri, 26 Feb 1999 09:29:41 -0500**
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Emne: **Re: Santilli's PIRT-paper**

Dear Prof. Wegener,

Thanks for your consideration. I accept all your changes on r
fact, the paper is now better and more understandable by a gr
audience.

Regards

R.M.Santilli
--

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