

# **SpringerBriefs in History of Science and Technology**

## **Series Editors**

Gerard Alberts, University of Amsterdam, Amsterdam, The Netherlands

Theodore Arabatzis, University of Athens, Athens, Greece

Bretislav Friedrich, Fritz Haber Institut der Max Planck Gesellschaft, Berlin,  
Germany

Ulf Hashagen, Deutsches Museum, Munich, Germany

Dieter Hoffmann, Max-Planck-Institute for the History of Science, Berlin, Germany

Simon Mitton, University of Cambridge, Cambridge, UK

David Pantalony, University of Ottawa, Ottawa, ON, Canada

Matteo Valleriani, Max-Planck-Institute for the History of Science, Berlin,  
Germany

More information about this series at <http://www.springer.com/series/10085>

Alexander S. Blum

# Heisenberg's 1958 Weltformel and the Roots of Post-Empirical Physics

 Springer

Alexander S. Blum  
Max-Planck-Institut für  
Wissenschaftsgeschichte  
Berlin, Germany

ISSN 2211-4564 ISSN 2211-4572 (electronic)  
SpringerBriefs in History of Science and Technology  
ISBN 978-3-030-20644-4 ISBN 978-3-030-20645-1 (eBook)  
<https://doi.org/10.1007/978-3-030-20645-1>

© The Author(s), under exclusive license to Springer Nature Switzerland AG 2019

This work is subject to copyright. All rights are solely and exclusively licensed by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG  
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

# Sources<sup>1</sup>

AMPG	Archive of the Max Planck Society, Berlin
DBP	Dieter Brill Papers (in private possession of Dieter Brill, College Park, MD, USA)
GBP	Gregory Breit Papers, Yale University
NBLA	Niels Bohr Library and Archives of the American Institute of Physics, College Park, MD
PJP	Pascual Jordan Papers, Staatsbibliothek zu Berlin
PRP	Paul Rosbaud Papers (in private possession of Vincent Frank, Basel, Switzerland)
PSC III	Pauli Scientific Correspondence 1940–1949 (von Meyenn 1993)
PSC IV-I	Pauli Scientific Correspondence 1950–1952 (von Meyenn 1996)
PSC IV-II	Pauli Scientific Correspondence 1953–1954 (von Meyenn 1999)
PSC IV-III	Pauli Scientific Correspondence 1955–1956 (von Meyenn 2001)
PSC IV-IV	Pauli Scientific Correspondence 1957–1958 (von Meyenn 2005)
WHP	Werner Heisenberg Papers (III. Abteilung, Repositur 93 of the Archive of the Max Planck Society, Berlin)
WZP	Wolfhart Zimmermann Papers (III. Abteilung, Repositur 128 of the Archive of the Max Planck Society, Berlin)

---

<sup>1</sup>All translations of German sources quoted in the text are by me.

# Contents

<b>1</b>	<b>Introduction</b> .....	1
<b>2</b>	<b>The Origins of Heisenberg’s Program</b> .....	5
2.1	Philosophical Groundwork .....	5
2.2	Explicit Formulation .....	12
<b>3</b>	<b>Heisenberg Triumphant</b> .....	23
3.1	Mathematical Consistency .....	23
3.1.1	Digression: The Lee Model .....	24
3.1.2	The Battle of Ascona .....	26
3.2	Empirical Adequacy .....	32
<b>4</b>	<b>Reception and Rejection</b> .....	43
4.1	General Reception .....	44
4.2	Pauli’s Turnaround .....	48
<b>5</b>	<b>Conclusions</b> .....	59
	<b>References</b> .....	63