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Michael Eckert

The Turbulence Problem

A Persistent Riddle in Historical Perspective

 Springer

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Preface

Turbulence belongs to the realm of fluid dynamics, a discipline founded on the solid pillars of classical mechanics. Its basic equations, the Navier–Stokes equations, have been established in the nineteenth century. Yet it is regarded as the last major unsolved problem of classical physics. The turbulence problem rose to prominence as one of the most persistent challenges of science. The eddies in the turbulent flow of a river or the smoke from a chimney elude a physical understanding from first principles.

In the course of the twentieth century, turbulence became a research field where high expectations met with recurrent frustration. This makes turbulence an ideal subject for the historian of science and technology. On the route towards a history of turbulence, this book is focused on what the actors in this research field perceived as the turbulence problem. At different times and in different social and disciplinary environments, the nature of this problem changed in response to changing research agendas.

When the participants in this quest review their research field, they focus on the progress made for solving the riddles of turbulence. In contrast to participants' reviews, my emphasis is rather on the broader context in which the turbulence problem(s) became enunciated. I am aiming for historical authenticity by quoting as far as possible from contemporary sources (letters, reports, papers). If the original quote was in German, I translated it in English (indicated by “Translation ME” in the footnote). My narrative is descriptive and proceeds in chronological order from around 1900 to the last decade of the twentieth century, so that one or another variant of the turbulence problem will be revisited in subsequent chapters in different circumstances. I do not aim at a comprehensive account but rather at an exemplary exposition of the environments in which problems become items of research agendas. From this perspective, the turbulence problem also provides more general lessons for the history and epistemology of science and technology in the twentieth century.

Munich, Germany
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Michael Eckert

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Abbreviations

AIP	American Institute of Physics, College Park, MD
APS	American Physical Society
ASWB	Arnold Sommerfeld. Wissenschaftlicher Briefwechsel. Band I: 1892–1918; Band II: 1919–1951. Herausgegeben von Michael Eckert und Karl Märker. München, Berlin, Diepholz: Deutsches Museum und GNT-Verlag, 2000 und 2004
DFD	Division of Fluid Dynamics of the American Physical Society
DFDA	Division of Fluid Dynamics of the American Physical Society, Archives, Lehigh University, Bethlehem, Pennsylvania
DLR	Deutsches Zentrum für Luft- und Raumfahrt
DMA	Deutsches Museum, Archiv, München
GAMM	Gesellschaft für Angewandte Mathematik und Mechanik
GOAR	Historical Archive of the DLR, Göttingen
IAS	Institute of the Aeronautical Sciences, New York
IAU	International Astronomical Union
IUGG	International Union of Geodesy and Geophysics
IUTAM	International Union of Theoretical and Applied Mechanics
NACA	National Advisory Committee for Aeronautics, Washington, D.C.
NPL	National Physical Laboratory, Teddington
RANH	Rijksarchief in Noord-Holland, Haarlem
SUB	Niedersächsische Staats- und Universitätsbibliothek, Göttingen
TKC	Theodore von Kármán Collection, California Institute of Technology, Pasadena
ZAMM	Zeitschrift für Angewandte Mathematik und Mechanik
ZWB	Zentrale für wissenschaftliches Berichtswesen der Luftfahrtforschung des Generalluftzeugmeisters

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