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★**David Hilbert and the axiomatization of physics (1898–1918).**

From *Grundlagen der Geometrie* to *Grundlagen der Physik*.
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Kluwer Academic Publishers, Dordrecht, 2004. *xvii*+513 *pp*. $179.00. *ISBN* 1-4020-2777-X

This is a massive scholarly book on the work of David Hilbert on physics. In more than 400 pages the author provides us with an in-depth analysis of the fundamental contributions of this mathematician-born scientist to many branches of physics, from radiation theory to thermodynamics, from mechanics to relativity.

The crucial methodological method identified by the author as the trait d'union of all of Hilbert's work in physics is the idea of "axiomatization", of being able to deduce the multiplicity of facts and mathematical/physical consequences of a physical theory from a limited but sufficient and consistent set of basic propositions and assumptions. From this point of view, as the author himself suggests, Hilbert's work in physics is the natural continuation of his previous and contemporary achievements in pure mathematics, above all in the foundations of geometry. Underlying this methodological preference is the struggle for clarity, conciseness, mathematical beauty and coherence that was a characterizing feature of Hilbert as a mathematician, and a sign of his genius.

It is in the development of relativity that Hilbert played a most important and influential role, and where Hilbert's ideas on the foundations of physics can be seen most clearly, as far as his contributions to physics are concerned. Consequently, the core of the book is represented by the final 3 chapters dealing with Hilbert's work on gravitation theory and his contribution to Einstein's General Relativity, starting from the influence of both Einstein and Mie's work on him, through a detailed account of Hilbert's own formulation of the theory of gravitation, following his interaction with Einstein (much has been written on this interaction and the author analyses the historical evidence of this with great care), to finish with the last work by Hilbert on General Relativity dating from 1918.

This is a complex but also a fascinating subject, given that what the author beautifully pictures is one of the best minds in the history of science, a towering figure in both physics and, even more, mathematics, struggling to gain understanding of one of the most elusive aspects of nature: gravitation, finally (even if only provisionally, as always in science) obtained thanks to the formulation of one of the most beautiful physical theories that we, as humans, have been able to produce: the General Theory of Relativity. As is to be expected, given the complexity of the subject, this book is no easy read, as the author tries to cover all the historical development of Hilbert's work, while at the same time trying to explain the mathematics and physics involved in this development, alongside the work of other illustrious scientists who either contributed significantly to the area of research under consideration, or influenced Hilbert's work on it: in particular, Minkowski, Born, Mie and Einstein.

The author does not refrain from dwelling on any little aspect of the story, be it mathematical,

physical, historical, personal or social, and, if this contributes to the difficulties the reader may face in going through this book, at the same time this contributes also to the pleasure the same reader may find in discovering the many facets that the development of Hilbert's work presented, the same facets that the slow and difficult progress of science shows in real life. As every scientist knows too well, intuition, genius, mistaken judgements, prejudices, social environment, scientific trends, conversations and fights with fellow scientists, hard solitary work, help of others, passion, understanding and misunderstandings, ambition, precise calculations and sketchy ideas, all contribute to the development of science, and nowhere is this amazing complexity of such a very human enterprise more clear than in the careful analysis of the history of any research achievement, as taught to us by a generation of philosophers of science, from Popper to Kunh, from Lakatos to Feyerabend, and as revealed once more by the present book.

If a criticism has to be brought forward to this book, this is that the discussion of the physical and mathematical concepts and results is not always accurate, ranging at times from being a bit confusing or puzzling to being, in a very few occasions, plainly wrong. However, the historical reconstruction, which was the main aim of the author, is, on the contrary, done with extreme competence and care, and it is, I think, of the highest quality.

Reviewed by *Daniele Oriti*