Modern Birkhäuser Classics

Matvei Petrovich Bronstein

and Soviet Theoretical Physics in the Thirties

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1. Auflage 2011. Taschenbuch. XI, 198 S. Paperback
ISBN 978 3 0348 0199 7
Format (B x L): 15,5 x 23,5 cm
Gewicht: 332 g

Foreword

The true history of physics can only be read in the life stories of those who made its progress possible.

Matvei Bronstein was one of those for whom the vast territory of theoretical physics was as familiar as his own home: he worked in cosmology, nuclear physics, gravitation, semiconductors, atmospheric physics, quantum electrodynamics, astrophysics and the relativistic quantum theory. Everyone who knew him was struck by his wide knowledge, far beyond the limits of his trade. This partly explains why his life was closely intertwined with the social, historical and scientific context of his time.

One might doubt that during his short life Bronstein could have made truly weighty contributions to science and have become, in a sense, a symbol of his time. Unlike mathematicians and poets, physicists reach the peak of their careers after the age of thirty. His thirty years of life, however, proved enough to secure him a place in the *Greater Soviet Encyclopedia*. In 1967, in describing the first generation of physicists educated after the 1917 revolution, Igor Tamm referred to Bronstein as "an exceptionally brilliant and promising" theoretician [268].

A collection of major works on the theory of gravitation, put out in 1979 to mark Einstein's birth centenary [90], contained an article by Bronstein. This was a pioneering work on quantizing gravitation that produced important physical results, the details of which we shall discuss later. The article marked Bronstein's peak, the significance of which goes beyond the history of physics. Today the quantum theory of gravitation occupies a special place in fundamental physics; indeed, the last fifty years have altered its interpretation and charted different ways to its solution, yet one of the characteristics discovered and described by Bronstein in 1935 is still beyond the scope of contemporary theoreticians. We are thinking of the fact that the classical relativistic theory of gravitation (the General Relativity theory) is incompatible with the quantum theory that Bronstein proved by physical analysis. Bronstein was the first to realize that the true synthesis of relativity and quantum ideas (the quantum theory of gravitation included) would require a major reconstruction of the concepts of time and space.

It is common knowledge that by altering these fundamental concepts, Einstein produced outstanding results in physics (he connected space and time in the theory of relativity and curved space-time in the theory of gravitation). No wonder, therefore, that those who came after him were tempted on many occasions to forecast "space-time" solutions to fundamental physical problems. Each time their

hopes were buried under new physical ideas and experiments. Bronstein's 1935 quantum-gravitational forecast has withstood the test of time. One may argue that forecasts are not, strictly speaking, an integral part of a physical theory; today it has become clear that the quantum theory of gravitation is destined to be a major achievement of theoretical physics and promote our ideas about space and time.

Illustrious lives are more than gemstones incrusted in mankind's history – they provide us with an insight into it. It was Bronstein's fate to live in one of the most tragic and fascinating periods in Russian history. Much of his life was shaped by the time he lived in. It seems that the biographical genre is guided by a principle akin to the quantum uncertainty principle formulated in the thirties: any attempt to isolate the principal figure from his historical milieu deprives his life of purpose and meaning. As quantum mechanics employs Planck's universal constant so "biographical mechanics" operates with its hero's "socializing constant", that is, a number of people, both friends and foes, who were close to him.

We have interviewed some twenty people from Byurakan in Armenia, Minsk in Byelorussia, Sverdlovsk in Russia and Oxford in Great Britain. It was a pleasant surprise that prominent scientists and highly placed administrators responded promptly to our requests to share their reminiscences about Matvei Bronstein. His former colleagues and friends from Moscow and Leningrad seemed to remain under the spell of his vivid personality. It was more than a natural desire of not-so-young people to recreate the past – they were obviously happy to speak about this remarkable man and fine scientist.

This book is based on stories from those who remembered Bronstein as "Mitya" and, from his student years, as "The Abbot". There were people who referred to him by his initials M.P., and by his name and patronymic, Matvei Petrovich (according to the Russian custom). These people still keep in their personal libraries his works and books with his personal dedications, summaries of his lectures and his poetic improvisations jotted down in his own hand.

Bronstein's lectures and articles, their memory still alive among his contemporaries betrayed a talented writer and profound scientist. It seems that he was fascinated with thoughts and ideas clothed in written and spoken words; no wonder teaching and popular science attracted him so much. His first scientific work appeared when he was 18 and not yet a student; his first popular scientific effort was published four years later.

He was a great lecturer and master of scientific explanation thanks to the profound knowledge and enthusiasm of a teacher and the talent of a writer. This urged him to write popular science books for children and young people, addressing the widest and most responsive group of readers. His books, which are as much fine literature as they are brilliantly presented science, are still very popular and have run into many editions. Time has not yet shelved them among other curiosities of literary and scientific history.

Bronstein's scientific articles bear the stamp of his literary talent. Unlike many shallow publications, where stylistic means are employed to camouflage a poverty of ideas, his elegance of expression was not an aim but a means of channelling the reader's attention.

Today scientific publications are written in a boring and dull style, as if authors are afraid of treading beyond the narrow path between "if ... then" and mathematical formulae and thus unwittingly demonstrating that science is a boring and impersonal trade. True, some of this can be accounted for by the natural desire to be precise and unambiguous. Any physicist promptly grows accustomed to this style. Bronstein refused to obey these rules, or, rather, he ignored them. As can be expected of theoretical physics in the twentieth century formulae took much of the space in his articles. At the same time, he quoted Newton in his article on the transmutation of photons into gravitons, employed a German proverb to summarize a major point, replaced the cautious "there are grounds to believe" with the positive "I believe", etc. Those who knew Bronstein well were not put off or shocked by his manner of writing: "He was M.P. and he knew how to present his ideas." This seemed to be part of his many-sided and harmonious personality.

Both prominent physicists who have already earned themselves a place in the history of physics and people far removed from the world of science were aware of Bronstein's talent for human communication. We were greatly encouraged by their reminiscences. Though not all names are mentioned in the text (if the author is obvious from the context), to avoid unnecessary complications we have deemed it necessary to say that we are greatly indebted to M. Bronstein's brother Isidor, his widow, Lydia Chukovskaya, his fellow students V. Ambartsumyan and E. Peierls (Kanegisser), his friends G. Egudin and S. Reiser, A. Migdal who did post-graduate course under him and Ya. Smorodinsky who was his student.

We are deeply grateful to all who shared their memories of Matvei Bronstein and the developments in physics in the twenties and thirties. They were A. Anselm, M. Veselov, S. Vonsovsky, I. Gurevich, L. Gurevich, D. Ivanenko, I. Kikoin, A. Kozyrev, M. Korets, R. Peierls, L. Pyatigorsky, I. Rozhansky and V. Saveliev.

We thank A. Migdal for his critical comments even if we sometimes disagreed with them, and also B. Bolotovsky, V. Vizgin, A. Kozhevnikov, A. Livanova, B. Yavelov and A. Yankovsky. Our special gratitude goes to G. Savina, who found documents indispensable for our book.

A complete list of Bronstein's works can be found at the end of the book. There are no references for his works if the context is clear enough. All contributions in square brackets belong to the authors.

Sections 2.4, 3.4, 3.9, 5.1, 6.3 were written jointly; Sections 2.1, 3.1, 3.2, 3.3 and 3.10 were contributed by V. Frenkel, the rest by G. Gorelik.

http://www.springer.com/978-3-0348-0199-7

Matvei Petrovich Bronstein
and Soviet Theoretical Physics in the Thirties
Gorelik, G.E.; Frenkel, V.Y.
1994, XI, 198 p. 4 illus., Softcover
ISBN: 978-3-0348-0199-7
A product of Springer Basel