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Alexander S. Sharov and Igor D. Novikov

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Edwin Hubble was one of the outstanding astronomers of the 20th century, who in a series of observations made in the 1920s discovered the expansion of the universe. Hubble opened the world of galaxies for science when he showed that spiral nebulae beyond the Milky Way are galaxies extending to the limits of the universe, and participating in a general expansion of the cosmos. The exploding universe of Hubble, now termed the Big Bang, determined the origin of the elements, of galaxies and of the stars.

This biography is the first complete account of the scientific life and work of Hubble. Significant family documents relating to Hubble are published here for the first time. The book gives a detailed description of the activities of this famous scientist, whose discoveries firmly established the United States as the leading nation in observational astronomy. The story is enriched by Alan Sandage, who worked with Hubble at the Mount Wilson and Mount Palomar Observatories.

The second part of this book describes the fundamental discoveries on the nature of the universe made subsequently, and thus sets his achievements in context. The result is a book that is a real classic of science, setting out the thrilling story of the exploding universe.

The authors are two prominent astronomers who have built on Hubble's work. Alexander S. Sharov is a researcher at the Sternberg Astronomical Institute, Moscow, who has worked on the nearby galaxies first studied in detail by Hubble. The cosmologist Igor D. Novikov is now at the prestigious Nordita research institute in Denmark, concentrating on black hole physics and the expanding universe.

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Frontispiece. Edwin Powell Hubble 1889–1953.

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# EDWIN HUBBLE, THE DISCOVERER OF THE BIG BANG UNIVERSE

ALEXANDER S. SHAROV

*P. K. Sternberg Astronomical Institute, Moscow*

and

IGOR D. NOVIKOV

*Nordita, Copenhagen*

TRANSLATED BY VITALY KISIN



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## Preface to the English edition

Years and decades have passed since Hubble's classical work. There is no question that he was the greatest observational astronomer since Copernicus. The three enormously important things he did were: he discovered galaxies, he showed that they were characteristic of the large-scale structure of the universe, and then he found the expansion. Any one of those is monumental and would secure his place in history.

*Alan Sandage*

From the interview for this book, given to Kip Thorne

The astronomical community did not overlook the centennial of the most outstanding astronomer of the 20th century, Edwin Hubble. On 21–23 June 1989, a symposium on the evolution of the universe of galaxies was convened in Berkeley, CA, dedicated to Hubble's memory. Three of the papers read at the symposium were devoted to the life and work of the great scientist. In Moscow, one of the authors (A. Sharov) presented a talk at about this time on Hubble's life and work, at the P. K. Sternberg Astronomical Institute in Moscow. In all likelihood, people similarly remembered Edwin Hubble in 1989 at other institutes and observatories. Several periodicals published articles about him.

Among the things said and written about Hubble on the occasion of the centenary, the most interesting was the talk delivered at the Berkeley symposium by D. E. Osterbrock, R. S. Brasher and J. A. Gwinn. These authors had worked through a staggering amount of archive material (81 references) and went through Hubble's life thoroughly, from his date of

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birth to the middle 1920s. They discovered information which had been completely unknown to everyone, including the authors of the present book. The text of this talk appeared in *The Evolution of the Universe of Galaxies – Edwin Hubble Centennial Symposium* (Berkeley, CA, 21–3 June 1989, edited by R. G. Kron, Conference Series Volume **10** (1990) San Francisco: Astronomical Society of the Pacific, pp. 2–14).

Nevertheless, there is still no detailed biography of Edwin Hubble, which is so needed and which would describe his entire life and his outstanding achievement. This is why we dare to offer to the general public our book, written and published in Moscow on the occasion of Hubble's centennial and now translated into English. Changes and additions to the text of the first part of the book, describing the life and work of Edwin Hubble, are quite small as compared with the Russian edition. We decided not to introduce into our text the information presented in the article of D. E. Osterbrock, R. S. Brasher and J. A. Gwinn. We simply invite the reader to read this excellent article too. Reading both texts would help one to get a better picture of Hubble's personality, his life and his work. The second part of the book, dealing with the expansion and continuation of the work to which Edwin Hubble devoted most of his life, has been enlarged to a considerably greater extent.

The second half of the 20th century is characterised by a constant intensification of the pace of life. It is not surprising that further progress in astronomy and space research in the three years since the publication of the Russian edition has brought us a huge amount of new knowledge. We have made an attempt to incorporate these new developments in the English edition.

A. Sharov  
I. Novikov



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## Preface to the Russian edition

A hundred and fifty years ago, half a century before the protagonist of this book was born, the great Russian poet Mikhail Lermontov wrote that ‘A preface is the first but also the last and the poorest thing in any book – it either explains the purpose of the book or serves as its justification and an answer to critics’. Many things have changed in this world since then but writing is still the same kind of work. Authors still cling to writing prefaces. The present authors are no exception. Lermontov complained that readers were bored with prefaces. In our dynamic age, this must be especially so. Still, the reader is advised not to hurry on and to read these pages before leafing through the main text.

The purpose of the book is clear. It is to describe the life and work of the American astronomer Edwin Powell Hubble (1889–1953) whose centenary was celebrated quite recently. The history of astronomy concerns many illustrious men who richly deserve the grateful memory of mankind. Edwin Hubble was outstanding even among this group.

Astronomers have a fine tradition of naming large telescopes after famous scientists – the 4-metre Newton telescope, the 5-metre Hale telescope, the G. A. Shain reflector in the Crimea. The first X-ray observatory in space was named after Albert Einstein; the first large optical instrument to be launched into space was named after Edwin Hubble. Why was he the first astronomer to be given such an honour? Edwin Hubble died forty years ago; he had only a third of a century, with two world wars thrown in, for accomplishing his task in science.

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The number of his published works is not especially large – only about seventy; the most significant of them appeared in the short period of five or six years in the middle and late 1920s.

It is precisely this work that Hubble is remembered for. It was Hubble who opened the world of galaxies for science when he proved that the nebulae outside the Milky Way are gigantic stellar systems often different from, but in many ways similar to, the galaxy which includes our Sun and its planets. However, the most important discovery was that of the red-shift in spectra of galaxies, which depends on distance from us and is perhaps the most revealing feature of the universe around us. The red-shift versus distance relation means that the world of galaxies is expanding. Therefore, the Universe was smaller in the past. By extrapolating back, contemporary physics has demonstrated that the primordial universe was different in everything – in the states of matter and radiation and in the rapidly evolving, violent development processes. What Hubble discovered is now known as the Big Bang, the primary explosion that gave birth to the universe as we know it. The explosive origin of the universe determined its subsequent evolution – the synthesis of chemical elements, the formation of galaxies and stars including our Sun and the planets, and ultimately the birth of living matter on at least one of them, the Earth; this gave rise to the human race with its desires, its passions and its rich history. This is why astronomers rank Edwin Hubble with Copernicus and Galileo Galilei.

Thus we have fulfilled the first criterion for prefaces.

Strange as it may seem, no monographs have been written about Hubble and even a sufficiently detailed biography remains to be published. Biographical data about him can be picked out from several obituaries and short entries, a few pages long, in reference volumes. Slightly more detailed data are included in a biographical essay on Hubble written by Nicholas Mayall and published by the American Academy of Natural Sciences. This essay is unfortunately too short.

It is not difficult to describe Hubble's work. His achievements are found either in his published papers or in the annual reports of the Mount Palomar and Mount Wilson observatories. To quote Alan Sandage who had worked with Edwin Hubble in the last years of his life; 'It seems to me that from the scientific standpoint, we know a great deal of what he did, and that was all documented in the records and in his publications. There is no question about the great things he did, but his personal life will be quite a bit more difficult to reconstruct'. An astronomer's life at an observatory is typically monotonous, regular and, outside professional

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interests, unexciting. It was not so with Hubble. He was always sensitive to events in the outside world and served not only science but his country too, in both world wars.

As far as we know, Hubble did not write reminiscences, as he believed that a scientist's life consists exclusively of his research work. One can hardly agree with that. The Russian physicist and historian of science Sergei Vavilov wrote that

The history of science cannot be limited to the development of ideas – to a similar extent it must be concerned with human beings, their peculiarities and talents and their dependence on the social conditions of their country and time... The life and work of pioneers in science are very important for progress in science and their biographies are a significant part of the history of science.

We agree with this attitude. We would like to tell the story not only of Hubble's work but also of his life, attempting to give this book a human dimension. It is not a simple task, though, for a variety of reasons. Hubble died many years ago. For new generations of astronomers in the USA, Hubble is a character from the history of science rather than a living memory. Only one or two still living Soviet astronomers actually saw Hubble, but they never had a chance to talk to him. Thus we have practically no living witnesses of Hubble's work in astronomy.

Another difficulty for the authors of the present book was that they had no opportunity to go through the Hubble archives, which are at the Huntington library in San Marino, a suburb of Pasadena where the Hubbles had lived. We did manage, though, to obtain copies of some significant documents from the archives and they are published for the first time in this book. We should note a peculiarity of Hubble's archives. The archives were set up and maintained by Mrs Hubble who not only adored but even idolised her husband. American researchers have noted that her devotion to the memory of her husband affected her selection of documents for the archives, which tend to present a somewhat idealised image of the late scientist. It was perhaps Mrs Hubble who depicted for Nicholas Mayall some events of their private life which have no independent confirmation and thus may be sentimental legends.

Though this biography is written in what we hoped would be a free rather than academic style, we have attempted a complete and thorough verification of all facts and events discussed in it. For each of them we have a recorded source. Unfortunately, in this way we may have automatically reproduced errors and misrepresentations of the originals when we lacked an opportunity to compare them with other sources.

In describing Hubble's research, we pay special attention to his main

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result: the discovery of the red-shift-distance relation. Its significance for our understanding of the universe is so great that a brief, or even detailed, account of it among his other results would be inappropriate. Therefore, we have dedicated a special section at the end of this book to the consequences of his great discovery.

The above outline is our answer to future criticisms of the book. We have greatly enjoyed collecting information on Hubble, often gleaning it in tiny bits. We should be happy if we have succeeded, at least to some extent, in depicting this highly attractive person, an outstanding scientist and a man of exceptional integrity. We were disappointed, as our project drew to a close, that we had failed to gather more biographical information on Hubble to share with readers. Robert Louis Stevenson expressed our feelings when he wrote: "To travel hopefully is a better thing than to arrive, and the true success is to labour." (From *El Dorado*.)

We should be satisfied with the thought that the book includes details that have been unknown to the American reading public. American researchers would definitely stand a better chance of writing a full biography of one of the greatest astronomers of the 20th century. They should not postpone this task for too long as the number of astronomers who can reminisce about Hubble, his work and his life is dwindling as the years go by.

We are grateful to all those who very kindly strived to help us in our project. They are the Russian astronomers P. Kholopov, P. Kulikovskiy, N. Samus, A. Rastorguev and Yu. Efimov, bibliographer N. Lavrova, A. Dobrynin, the USSR Ambassador in the USA at the time when we started working on the book, Paul Hodge, Professor of Astronomy at the Washington State University, USA, Malcolm Longair, Astronomer Royal for Scotland, and many others. Our project was also warmly supported by Professor E. Kharadze.

We are especially indebted to Professor Kip Thorne of the California Institute of Technology. In fact, we regard him as our co-author. With the kind permission of the Huntington Library, he supplied us with documents from the Hubble Archives. He arranged for and conducted a taped interview with Alan Sandage from the Space Telescope Institute over long-distance telephone. He contacted Mrs Helen Lane, Edwin Hubble's sister, and asked her to write for us reminiscences which were essentially the only source of information about the early years of Hubble's life. We are extremely indebted to Mrs Lane and Alan Sandage for their kind assistance, without which the book would be incomplete.

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When we received a warm personal letter from Mrs Lane in 1988 signed in slightly shaky handwriting – she was 89 at the time – we were pleased to learn that her family welcomed our intention to write a book about Edwin Hubble. We believe that it was quite unexpected for them that a book about the great American astronomer would be published in far-away Russia. It was encouraging to learn that a great-grandson of Mrs Lane was interested in astronomy and hoped to take on the profession of his illustrious relative. Let us hope with Mrs Lane that ‘In the far future, perhaps, ... he will develop into an astronomer of his Uncle Edwin’s caliber’ and that the Hubble family will go down in history as one of those families in which talents in a particular field keep on appearing in several generations. Such were the musicians Bach in Germany, the mathematicians Bernoulli in Switzerland, the astronomers Struve in Russia and the USA, the biologists Thomas and Julian Huxley and the author Aldous Huxley; the latter was a personal friend of Hubble’s.

This book is intended for a wide readership. We hope that both amateur and professional astronomers, particularly those who are in love with the history of their science, will find something new and entertaining in it. We shall welcome comments and remarks from our readers. We should be especially grateful if some astronomers can share with us unpublished facts and observations on Hubble’s life and work that they retain from personal contact with Hubble or have inherited as legends coming down from their teachers.