Observatory at Green Bank, West Virginia. He was also president of the International Astronomical Union, at a time when modern astrophysics and radio astronomy were beginning their spectacular development. In summary, he was a leader of men during an important epoch. Nevertheless, he found the time to do much observation and research and to publish nearly a thousand papers.

What was the character of this man who achieved so much and earned so many distinctions ? In appearance and bearing he looked rather like a general in mufti, and indeed he had served in the Russian White Army at one time. His attitude to scientific matters was somewhat military too: simple effects have simple explanations and he expected to be able to find such explanations without too much delay in any instance. He was direct and outspoken and he would give his frank opinion to whoever needed it. This might be some astronomical Procrustes, trying to stretch the protesting universe into his preconceived theoretical bed; it might be some committee in Washington attempting to push through a harebrained scheme that only a committee could dream up; or it could just be a research assistant who had done a bad job.

Now, some years after his death, thirty-six astronomers have collaborated to produce this volume in honour of his memory. Many are former associates, two (Strömgren and Morgan) were subsequent directors at Yerkes, and one (Swings) a later president of the IAU. Not all were directly associated with Struve but, as Ginzburg remarks at the end of his paper, this was "all the more reason . . . to write a paper . . . to pay tribute . . . to the memory of a man whose name is inseparably linked with the development of astronomy in this century".

Indeed, Ginzburg, who had never met Struve, pays the most sincere homage, writes the most useful contribution, on cosmic ray astrophysics, and comes closest in spirit to the title of the book. Struve would have doubtless liked this article. He would have also liked those by Mrs Böhm-Vitense on magnetic stars, and by Swings on molecular astrophysics; the former because it takes a simple model and explores its consequences in common-sense fashion, the latter because it starts from a historical point of view and gently brings the reader up to date.

But what would Struve have said about a book called *Modern Astrophysics,* in which chapter one deals with the question of what Plutarch might have known about the Moon ? What would he have said about contributors who sent in bits of lecture notes, accounts of investigations that turned out to be inconclusive, lengthy computer programs or other unpublishable matter ? What would he have said about the erratic typesetting and proof-reading and the strange lapses in English syntax ? Those of us who knew him will have little trouble in answering these questions.

Doubtless the organizers of this volume meant well, but their achievement does not match their intentions. The man to whom they wanted to pay tribute deserves a better memorial.   F. D. KAHN

the subject will be particularly welcome to those who wish to engage in numerical celestial mechanics. The author's principal object has been to provide his readers with as complete an account of perturbation methods and their numerical application as can be put into a book of reasonable size; there is little doubt that he has succeeded admirably, and has made a valuable contribution to the literature which every intending practitioner should be advised to read. It may seem presumptuous for a non-practitioner to express such opinions on a matter outside his competence, but the general excellence of the presentation leaves room for no other, and, on consultation, practitioners have confirmed these views.

To give some idea of the scope of the book, the first chapter mentions time reckoning briefly and goes on to give an account of coordinate systems and the relations between them; the second chapter discusses the theory of the major planets from the point of view of the Laplace–Newcomb method, and the third contains a discussion of the theory of the minor planets based on Hill's method and Poincaré's periodic orbits. Succeeding chapters deal with satellite theory, Hill's lunar theory, and cometary theory using Cowell's method. There are seventeen appendices containing various useful formulae, astronomical constants, and orbital elements, and there is also a long list of references, mostly to papers by Russian authors. The translation editor has provided some general references in English, but has not attempted to give references to recent original papers in English, which, as he remarks, can be obtained readily by thumbing through suitable journals; he has also provided a useful index.

The author assumes a general background knowledge of mathematics, mechanics and gravitational theory, and proceeds to develop each of the methods in detail, with clear instructions on how to proceed with their applications. The text is supplied liberally with numerical information about the orbital elements of planets and satellites, and there is mention, with references, of methods other than those which are developed in detail; in addition, there is a lot of historical information and some fascinating asides to enliven the otherwise inevitably solid nature of the material. One possible criticism is that there is little indication of the merits and demerits of the various methods from the point of view of convenience and computational accuracy, but this is consistent with the general philosophy of omitting background material that can be found elsewhere, and to have included it would have increased the length of the book unduly. The format is clear and the translation is good. It appears that the equations have been taken directly from the original Russian text and that they have been reduced in size during the process; this results in the characters in some of the more elaborate formulae being rather too small for comfort, but the reproduction is clear, so they can be read by those with good eyesight. There are some errors in the text, but most of them are rather obvious and should not cause confusion.   G. N. WARD

CELESTIAL MECHANICS

Analytical and Numerical Methods of Celestial Mechanics
By G. A. Chebotarev. Translated by Scripta Technica. Translation edited by Ludwig Oster. (Modern Analytic and Computational Methods in Science and Mathematics.) Pp. xviii + 331. (Elsevier: New York, Amsterdam and London, 1967.) 175s.

THE general theory of celestial mechanics has been well covered in the literature, but books for the practitioners who have to compute perturbations and construct ephemerides have not been so common, and this exceptionally readable introduction to the practical aspects of

MEANINGFUL HISTORY

A History of Mathematics
By Carl B. Boyer. Pp. xv + 717. (Wiley: New York and London, September 1968.) 97s.

THE history of mathematics is not so easy to tell as the many authors of books usurping this title seem to think. The requirements of meaningful history-writing are not satisfied by the mere recital of a succession of mathematical achievements of widely varying types and quality. The all but smooth growth of mathematical thought only acquires significance of it is brought into relation with the vicissitudes of the intellectual environment in which it has taken place and the social needs to which it responded.