

shown what to expect. All astronomers should say a big thank you to Jack Newton for making their telescope time more productive and more enjoyable.

Using the Telescope, by J. Hedley Robinson (David and Charles: Newton Abbot, UK, £4.95) is a different matter. I will agree with the author that a book in which the amateur observers could find "comprehensive instructions for the proper care and maintenance of their telescopes, together with explicit explanations of correct observational techniques for all celestial bodies that they are likely to be interested in" would be extremely useful. Unfortunately the book under review isn't it. Robinson doesn't go far enough. The budding astrophotographer is told next to nothing about the science of photography and is fobbed off with the 'trial and error method'. The section on telescope mounting is complicated by a

lack of diagrams and by mislabelling the two that are given. When it comes to observational details our appetites are wetted and then we are left up in the air. I'll give you a typical example: "Since then many TLPs have been recorded in a number of craters, both inside and out"—we aren't told which craters. The spectroscopy "is equipped with one or more prisms, set at suitable angles for the light to pass through each in succession," but we are given no hint as to what the angles might be or what prisms to use. I think the amateur observer would do much better by saving a bit more money and buying *Astronomy: A Handbook*, edited by G. R. Roth (Springer: Berlin, 1975).

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Portrait of five heroes

This Wild Abyss: The Story of the Men Who Made Modern Astronomy. By G. E. Christianson. Pp. 461. (Free Press/Macmillan: New York; Collier Macmillan: West Drayton, UK, 1978.) £9.75.

WHAT a pity! as Sir George Sitwell was fond of remarking: such a wasted opportunity. It is a long time since a general book on the history of astronomy was published and it will be some years yet before the new scholarly history (sponsored by the IAU), now in preparation, is before us. Although one's initial expectation that the "makers of modern astronomy" might include such figures as Hubble and Shapley is proved mistaken, a sound survey of the history of astronomy to Newton would be worth having as so much new work has appeared in recent years. There has been the debate about megalithic observatories, many exciting discoveries made about late Islamic astronomy by E. S. Kennedy and others and the outpourings associated with the anniversaries of Copernicus and Kepler, not to mention whole new worlds of scholarship devoted to Galileo and Newton. A new survey of early astronomy could be both more technically competent and more rich in content, as well as more vivid in its discussions of problems, than anything that has appeared yet. Mr Christianson, however, has only had a slight success in releasing himself from a familiar and by now dated pattern.

He makes no claim to be a technical historian of astronomy, which is fair enough; his chief aim has been to write biographies of five great figures: Coper-

nicus, Brahe, Kepler, Galileo and Newton. But he writes, as perhaps he could not but do, about a good deal else including Greek astronomy and medieval civilisation. A general history (even by a non-specialist author) should get the broad historiography and the basic facts right. Mr Christianson tells us that Ptolemy's orbital elements "did not fit comfortably into" the crystalline spheres of Aristotle "and whether or not Ptolemy even believed in such spheres is not known; they receive no mention in his writings". Not so; solid spheres figure prominently in Ptolemy's *Planetary Hypotheses* and are indeed mentioned occasionally in the *Almagest* itself (see O. Pedersen, *Survey of the Almagest*, 1974, 167, 391-7).

Mr Christianson's whole discussion of ancient astronomy is impaired by his failure to grasp the point emphasised seventy years ago by Pierre Duhem that the Greek astronomer was a mathematician, not a philosopher; and correspondingly that it is impossible to appraise the Copernican revolution properly without first seeing the significance of his opposite position that mathematics, far from merely saving the appearances, is an essential key to physical reality. Mr Christianson seems unfortunately to be wholly unaware of the writings of Duhem—widely regarded as providing the basis for the historiography of medieval science as it has flourished during this century—and only ignorance, again, can account for his extraordinary statement that "the study of the Middle Ages" has "until rather recently languished in our institutions of higher education".

Although the author is more familiar with recent studies of Galileo and Newton, his biographies are still marred by serious mistakes, such as the assertion that Galileo discovered the law

of falling bodies by rolling "objects of different weight . . . down an inclined plane . . . keeping time with a specially designed pendulum"; his belief that Descartes proposed to correct chromatic aberration by means of aspherical lenses; and his supposition that Newton plunged deeply into the study of the "occult" (Newton did indeed read deeply in alchemical authors and interpret scriptural prophecy, but no-one has yet made him out to be a warlock).

In general, the ideas of established standard works like T. S. Kuhn's *Copernican Revolution* and Giorgio de Santillana's *Crime of Galileo* are fairly represented, and with Newton the author has made use of Frank Manuel's psycho-analytical portrait, Mrs Dobbs's investigation of Newton's alchemy, the publications of R. S. Westfall, and other recent sources. He ends with an exposition, highly laudatory, of Kuhn's *Structure of Scientific Revolutions* with which, he writes, he agrees that "there is nothing absolute in what is called scientific truth", that is, a statement is true so long as we do not suppose it false.

Mr Christianson has no strong thesis of his own, unlike Arthur Koestler whose *Sleepwalkers* rightly aroused so much interest a few years ago (his ideas too are reflected in this book). Rather, Mr Christianson has attempted to synthesise recent writing in the history of science and particularly the interpretation of the Scientific Revolution. If he is not fully in control of his material this is in part because the history of astronomy has become—largely through the leadership exercised by Otto Neugebauer and his students—a highly technical subject, or rather one should say has been restored to its position as a highly technical subject.

In the personal aspects of his biographies Mr Christianson is on smoother ground, and he shows skill in bringing out the characters and intellectual qualities of his subjects in broad terms. If he sometimes stresses the melodramatic—Tycho's metal nose, Galileo's bastard daughters, Kepler's difficult mother and Newton's neuroses—this is what others have done before, including Koestler. For a philosopher like Galileo to have a mistress, and for a mathematician like Newton to have died a virgin is equally newsworthy. More seriously Mr Christianson presents a reasonably coherent and intelligible, if occasionally flawed portrait of his five heroes and conveys the integrity of the epoch that began with Copernicus and ended with Newton even if (as in any popular account) subtle nuances are absent. **A. Rupert Hall**

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