been useful. Because the book was originally published in 1990, and perhaps also because of the author's reluctance to speculate, there is little discussion of the astronomical symbolism of the cult, but the translator has included a section on this material in his suggestions for further reading. In summary, the book is a comprehensive and reliable introduction to the cult of Mithras. It can be read to gain a general understanding of the cult before following the more specialized (and speculative) literature about its possible astronomical symbolism.

Clive Davenhall

References


It is a pleasure to read another book from the prolific pen of that master astrophysicist-historian, Donald Osterbrock, Professor Emeritus of Astronomy and Astrophysics at the University of California, Santa Cruz, and former Director of the Lick Observatory. His target on this occasion is Walter Baade, arguably the most influential observational astronomer of the twentieth century, and his aim is "... to present the known facts of Baade's life and scientific career in interesting and readable form and to let the reader draw his own conclusions ..." (page vii).

Wilhelm Heinrich Walter Baade was born in Schrötinghausen, Germany, in 1893, and trained at Göttingen University, receiving his Ph.D. in 1919 for a thesis on the spectrum and orbit of β Lyrae. Shortly afterwards he obtained a post at Hamburg Observatory where he built an international reputation through his photographic studies of variable stars, globular clusters and galaxies, and spectroscopic analyses of gaseous nebulae and selected stars. He also discovered a number of minor planets and a comet.

As an exciting interlude during this research work, Baade spent 10 days in the USA in 1925, visiting observatories in eastern states. This whetted his appetite to return and work there, which he did 1926-1927 when he held a one-year Rockefeller Foundation fellowship, sharing his time between Harvard College, Yerkes, Lick, and Mount Wilson Observatories. After this "Wanderjahr in America", Baade returned to routine duties in Hamburg, but he hankered for a chance to work permanently in the States, using the world's largest telescopes.

In 1931 his dream came true when Adams offered him a post at Mt. Wilson Observatory. Although Baade was unquestionably well qualified for the position, Osterbrock suspects that Adams also wanted another bright, dynamic astrophysicist on staff – but this time a team-player – who could serve as a counterpoise to Hubble. Whatever the facts of the matter, Baade was in his element for "Mountain Wilson Observatory was unquestionably the most important observational astronomy research center in the world. Its 100-inch reflector was the largest telescope in existence; it and its 60-inch were both superb instruments at an excellent site ...” (page 50). Over the next decade he was involved in a range of research projects involving nebulae, globular clusters, supernovae and supernova remnants, clusters of galaxies, and he witnessed progress on the 200-inch reflector at Palomar, an instrument which he was destined to use with distinction.

Never a Nazi supporter but always a German at heart, it is perhaps ironic that Baade did some of his finest research, in America, during the Second World War, including the discovery of the existence of two distinct stellar populations, comprising young and old stars, respectively, which "... opened up the fields of study of stellar and galactic evolution that have made up so much of astronomy in our time, but which were sterile and unproductive before his discovery ...” (page 1).

One of the most interesting post-War phases of Baade's life was his involvement with radio astronomy, and this is recounted by Osterbrock in Chapter 6. From the end of the 1940s, Baade and his friend Rudolph Minkowski worked with Australian and British radio astronomers

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in identifying optical correlates for the newly-discovered 'radio stars', producing some fascinating results. While some sources were associated with well-known galactic objects (e.g. Taurus A with the Crab Nebula), others were linked to galaxies. Baade also investigated polarization in the Crab Nebula and the jet in M87, two well-known radio sources. In these critical formative years of radio astronomy, Baade was one of the few leading optical astronomers who from the very start was prepared – nay eager – to work with these strange new bed-fellows, radio engineers who knew surprisingly little about astronomy. With help from Baade, Greenstein, Minkowski, Oort, and a few others they quickly overcame this impediment.

Another of Baade's important post-War research results, and one that endeared him to readers of newspapers and scientific magazines, was his effective "doubling the size of the universe". This brought the apparent ages of Earth and the Universe into closer agreement, but with the benefit of hindsight Osterbrock feels that Baade's new distance scale was probably "... not as intrinsically important as his population concept ..., as his far-ranging work on supernovae, or as his leading the way in the identification of the radio sources ..." (pages 162-163).

Apart from his publications, another way Baade shared his research results with colleagues and interested members of the public was through conferences (including IAU General Assemblies and symposia), seminars, courses, and public lectures. He was an excellent speaker, and the passion of his involvement in forefront research generally rang loud and clear. Through his lectures, discussions, and letters he inspired a generation of graduate students and young astronomers to work on stellar issues, galactic research or nebulae, and he also had a profound impact on his contemporaries, in one way or another touching the lives and hearts of a great many astronomers world-wide. One of the features of Osterbrock's book is the way in which he interweaves research and the social fabric of Baade's relations with his colleagues. And in this context, the major falling out between Baade and Shapley over the new distance scale (pages 171-174) makes compelling reading.

As an Australian-based astronomer I was also fascinated by Osterbrock's account of Baade's six-month sojourn in Australia during 1959, the year after his retirement from the Carnegie Institution. Baade obviously enjoyed discussing forefront research with the optical astronomers at Mount Stromlo Observatory and the radio astronomers at the Division of Radiophysics in Sydney (where I begin work as a lowly Technical Assistant just two years later, straight after leaving secondary school), lecturing at the Australian National University, attending a conference in Perth and a symposia in Canberra, and observing the globular cluster NGC 6522 with the 74-inch reflector at Stromlo (even if this was "the most uncomfortable instrument with which [he] ever observed" – see page 205). But at times he also found the experience exhausting, as when he and Bok, the dynamic new director at Stromlo, spent a hectic week exploring Western Australia in a crowded automobile and sleeping in outback accommodation whilst in search of a suitable observatory site. As Osterbrock says, "Bok was a compulsive talker and doer; his heart was in the right place but he did not realize that he was wearing Baade down." (page 206). This comes through clearly in the photograph of him on page 207, taken somewhere in the Australian desert. He looks a tired old man!

This strenuous Australian experience undoubtedly contributed to Baade's rapid physical decline once he and his wife settled back in Germany in late 1959, and it was not long before he was bed-ridden and unable to write. In 1960 January he underwent an operation in Göttingen but never recovered and died suddenly in June of that year. According to Osterbrock, "Baade was born, lived, and died a German. He never wanted to be anything else. He loved his country, but best of all he loved his native region, Westphalia, where he was born, educated ...[and] buried." (page 212). But for Baade, astronomy always took precedence over his homeland, and this is why he made his greatest discoveries in America. Yet he never chose to become an American citizen, always planning to live in Germany after retirement, and he and his wife always spoke German at home. His death was a loss not just to Germany and America but to world astronomy.

All in all, this is a captivating book with that wonderful mix of science and sociology that we have come to expect from Osterbrock's pen. It is a veritable astronomical adventure, the story of one man's remarkable exploration of the Universe. And for those wishing to delve further into Baade's remarkable achievements there are 27 pages of notes and references.

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Beautifully-written and well illustrated, this book is a bargain at just US$29.95, and it deserves to be on the bookshelf of every astrophysicist or historian interested in twentieth century astronomy.

Wayne Orchiston


The invention of the telescope in 1610 and two centuries later the application of photography revitalized astronomy. Warren De La Rue, a pioneer in sky photography at Kew Observatory, England, devised in 1857 a concept to obtain photographic star charts and a catalogue of star positions for the whole sky. Realization of this intent was advanced by successful attempts in celestial photography by E.C. Pickering at Harvard and D. Gill at the Royal Observatory, Cape of Good Hope. A permanent international Commission was formed and an astro-photographic Congress held at Paris Observatory in 1871 by invitation of the French Academy of Sciences. A second Congress in 1891 adopted a Working Plan and allocated regions of the sky to observatories in the northern and southern hemispheres to cover the entire sky from +90 to -90 degrees for stars down to around 13th limiting magnitude. This unique international project was from its inception organized by a permanent international Committee, presided over by the Director of Paris Astronomical Observatory, Admiral Ernest B. Mouchez. However with the foundation in 1919 of the International Astronomical Union (IAU) for promotion of astronomy, this body assumed responsibility for this first truly international proposal. IAU Commission 23 for Carte du Ciel was much later assigned to conclude this effort and during 1964 provided financial support for publication of the entire 24 Volumes of the Astrographic Catalogue.

As the title indicates, this publication compiles original correspondence for Carte du Ciel received and archived at Paris Observatory between 1880-1923. These 732 letters between participants and Paris Observatory trace the concept and working plans for the Carte du Ciel. They reveal the historical development of astronomy in the second half of the nineteenth and first half of the twentieth centuries with improvements in photography and telescope technology, specifically the construction of optical lenses of large aperture and the design of telescopes to suit the particular photographic requirements of the proposed Carte du Ciel. An increase in sensitivity of photographic emulsion contributed to recording of fainter stars with shorter exposure times. Measuring equipment was designed and built to derive positions of celestial objects from photographic plates. To establish a Fundamental Star reference system of accurate positions, meridian transit circle telescopes were commissioned. Collaboration was developed between selected observatories to obtain more than 15,000 photographic plate exposures covering the entire sky. Essential elements and requirements were identified and discussed between participants. Each observatory was to secure the best possible observing equipment and to comply as far as possible with identical instruments and methods. They were at the same time to support other participants with advice and planning in order to achieve a library of photographic maps of the whole sky.

The author of this publication, Ileana Chinnici from Palermo University, Italy, received a scholarship to remain one year at Paris Observatory to research historical archived correspondence. She became familiar with the extensive and important Carte du Ciel correspondence received between 1880 and 1923. From the immense amount of letters preserved in this archive, she recognized the historical significance of this important first worldwide scientific collaboration. In preference to herself writing about the logistics and turmoil of this extremely large endeavour, the author decided to publish the text of the 732 letters as transcribed correspondence in their original languages. Her primary purpose was to compile material for other researchers. In this way, readers are presented with text of letters disclosing the struggle this venture would endure during the World War and other political and