Reviews

Worlds Without End: The Historic Search for Extraterrestrial Life, by R. A. S. Hennessy (Tempus Publishing, Stroud, Gloucestershire, UK, 1999), 160 pp., ISBN 0-7524-1450-X, £18.99, US$29.99, hardback.

Does life exist elsewhere in the universe? This is a question frequently posed over the years in the mass media, because of the huge public interest. Despite this, serious discussion of the search for extraterrestrial intelligence, through such techniques as radio spectrum interrogation, was frowned upon by many 'serious' scientists until quite recently. NASA was banned from spending any US government funds on such work. Disparaging remarks were made about exobiology being "the only discipline with nothing to study", or similar.

Suddenly, though, the search for extraterrestrial life is in vogue. In 1996 pronouncements were made concerning the possible identification of microfossils in a meteorite known to have come from Mars. NASA has promoted the Europa Orbiter in its outer solar system mission sequence, largely because it is believed that Europa (one of the large moons of Jupiter) may have an ocean under an icy crust, and that could mean life. Around the world thousands of enthusiasts leave their home computers running to crunch data from radio searches for signs of intelligent life. Substantial slabs of observing time at major optical observatories are allocated to projects in which searches are made for planets orbiting nearby stars. On our own planet microbial life has been found thriving in environments where respected scientists had previously opined that it was 'impossible', and now there is even a journal dedicated to research on extremophiles. NASA has established a dispersed Astrobiology Institute, and frequent international conferences are held to discuss progress.

The cynic, of course, might comment that there has been none, because no definitive evidence for extraterrestrial life has been revealed. That's not the point, though. Even by considering such questions, we move ahead. And this book by Roger Hennessy describes just how long the question of the possible plurality of worlds has been a subject of philosophical debate. Very recent history, then, is misleading: this is not a newly invented discipline that has arisen only in the past few decades.

Some parts of the tale that Hennessy tells will be well known, starting from Plato's musings in the fourth century BC, through Giordano Bruno's many worlds in the sixteenth century, Thomas Wright of Durham in the eighteenth, and on to the present with such questions as the Fermi Paradox and suggested reasons why we have not (yet) found proof of life elsewhere. Along the way we are told of the absurdities that have been spawned, such as William Herschel's inhabitable Sun and the 'Martian canals' debacle.

All these will be familiar to most readers, but in addition Hennessy has rooted out a host of other ideas that have been mooted over the centuries. For most he provides good copies of original illustrations (all in black and white), coming close to bringing their ages to life. It is easier to sympathize with the authors of these schemes – many of them, in retrospect, seeming bizarre – if we can see the actual scenarios they were imagining.

For a brief introduction to the long-term historical development of the multifarious notions of extraterrestrial life, this book is highly recommended. You would want your library to have a copy. For specialists in the area, it is unlikely that you will learn much new, but it would still be a handy book to possess for the illustrations alone.

Duncan Steel

Treasure-Hunting in Astronomical Plate Archives, Proceedings of the International Workshop held at Sonneberg Observatory during 4-6 March 1999, edited by P Kroll, C la Dous, and H J Brãuer Acta Historica Astronomiae, **6** (Verlag Harri Deutsch: Thun and Frankfurt am Main, 1999), 266 pp., ISBN 3-8171-1599-7, soft cover, DM 38.00 (about £20), 147 × 208 mm.

Photography was adopted gradually by astronomers during the nineteenth century. Briefly, it became common during the 1880s, though the take-up was drawn-out and varied between institutions. The photographic era ended about a hundred years later, around 1980, after which photography largely gave way to electronic detectors such as Charge-Couple Devices (CCDs), though again the change-over was piecemeal and protracted. Indeed, some major photographic surveys are still in progress. In the intervening century the photographic plate was the pre-eminent imaging detector used in astronomy, and considerable archives of photographic plates survive from this era. Plates were used to record both direct images of the sky and spectra of various sorts. Most observatories which operated during the period had a 'plate store' where the exposed plates were carefully catalogued and stored for future use.

Treasure-Hunting in Astronomical Plate Archives is the proceedings of a workshop held at the Sonneberg Observatory during March 1999. The workshop was about preserving archives of

astronomical plates and exploiting the wealth of information that they contain. It was not principally about the history of astronomical photography per se, though the preservation and use of the plates cannot be divorced from the circumstances in which they were taken. In the context of the present journal the volume falls more into the area of astronomical heritage rather than astronomical history. Indeed, in terms of observational material the photographic archives are probably the major heritage bequeathed by twentieth century astronomy. The workshop was attended by forty-odd people, mostly from institutions in Europe, but with a handful coming from each of the US, the UK and the rest of the world. The proceedings are dedicated to Barry Lasker, who died tragically shortly before the meeting was held. It is a tribute which is both well-deserved and which, I suspect, he would have appreciated.

The workshop largely concentrated on direct photographs rather than spectra. Though some of the plates were taken for individual research projects the majority were part of systematic programmes. Such systematic programmes usually fall into two categories: sky surveys and sky patrols. In a sky survey typically the entire sky, or at least a substantial fraction of it, is photographed once in order to map the position and brightness of the objects visible. A number of major survey programmes are extremely well-known. The first was the ambitious (indeed, perhaps over-ambitious for its time) Carte du Ciel which started in the late nineteenth century. Since the 1950s optical sky surveys have been dominated by the large Palomar, UK, and ESO Schmidt telescopes, and the atlases made from the surveys conducted by these telescopes are well-known and indispensable tools of astronomy. The sky patrols are perhaps less well-known. Here selected areas of sky are repeatedly photographed over an extended period of time, principally to detect and monitor variable stars. Extensive sky patrols have been carried out at Harvard and latterly Sonneberg and Tautenberg. The number of plates in archives around the world is estimated to be in excess of two million (corresponding to a total area of glass of more than 10^9 cm^2). Many of the older plates have a relatively bright limiting magnitude of perhaps 12 – 15 visual magnitude, though modern Schmidt plates go much deeper.

The uses of archival plates, like archival data generally in astronomy, derive from the circumstance that the 'fixed stars' are neither fixed nor of constant brightness. Comparison of the positions of stars on old plates with modern observations gives a long baseline for the determination of proper motions. Comparison of the brightness of an object at different epochs allows any variations in its brightness to be monitored. Incorporating measurements from archival plates currently allows substantial improvements to the accuracy of proper motion determinations, though future astrometric satellites, such as GAIA, will make measurements which are sufficiently accurate that incorporating the archival data will add little additional precision. The situation is rather different for variability studies: many objects show secular or long-term changes and the historical data are irreproducible and hence irreplaceable.

There are, however, a number of problems with using archival plates. Plates are held in numerous archives scattered around the world. Sometimes the archives are difficult to access and their contents are not always properly catalogued. Once a plate has been retrieved from an archive many observatories now only have limited measuring facilities. Further, the expertise in handling photographic data is dwindling as the staff who were familiar with them retire. Finally, photography is an analogue medium. It is practical to measure only a small fraction of the information on a plate using manual methods. If all the information is to be extracted then the plates must be scanned digitally and the resulting digital images analysed using computers. Also, it is difficult to compare photographic data with more modern digital images unless the former are converted to a digital form. Though there have been a number of major digitization programs, mostly of the Schmidt surveys and using specially-designed and highly-accurate scanners, most plates have not been digitized.

Treasure-Hunting in Astronomical Plate Archives considers the problems and possibilities of using plate archives. It is divided into six sections: Scientific Introduction, Technical Concepts and Solutions, Astrophysics, Astrometry, Data Reduction, and Databases. Each section starts with a useful introduction (all except the first by Kroll) followed by a number of papers of varying length. The 'Scientific Introduction' includes a survey by Hudec of the various large plate archives, which is a useful introduction to the data that are available. The papers in the 'Technical Concepts and Solutions' section are mostly split between descriptions of individual digitizing scanners or descriptions of individual plate archives, in both cases largely from European institutions. There is also a paper by Tsvetkov and his colleagues about their 'Wide Field Plate Database'. This database is a major undertaking to produce a comprehensive compilation of wide-field photographic plates. It can be searched remotely via the Internet and is an extremely useful tool for finding plates that might be suitable for a given project. A typical query might be to find a list of plates which have observed a particular region of sky.

Most of the papers in the 'Astrophysics' section describe investigations of variable objects; not just variable stars, but also supernovae, active galaxies, quasars and searches for the optical counterparts of Gamma-Ray Bursts. The 'Astrometry' section largely reports proper motion studies, though there is a paper by Boattini describing searches for Near-Earth Objects (NEOs), which is another important application for archival plates: 'pre-discovery' images identified and measured on

archival plates will usually lead to substantial improvements in the orbital elements of newly-discovered NEOs and other asteroids. The 'Data Reduction' section has papers on various aspects of the reduction procedure for photographic data. The final section on `Databases' describes the use of database software not just for the traditional application of manipulating the final catalogues of objects detected on the plates, but also for managing the data reduction pipeline. Some ambitious and sophisticated projects are described.

The volume has the usual problem of conference proceedings that it is a collection of disparate papers which will be of varying interest, though here this is mitigated by the very reasonable price. It is likely to be useful to anyone working with photographic archives in astronomy, and, indeed, perhaps to anyone with a more general interest in astronomical archives. All the papers are in English, though it is obviously not the first language of most of the authors, and the text is enlivened by the occasional idiosyncrasy. Finally, these proceedings are not the only report of the workshop; Argyle (1999) published a summary shortly after the meeting was held. The efforts to digitize photographic archives have continued apace since the meeting and the recent report by Griffin (2001) summarizing these developments, and giving a number of useful references, might also be of interest.

Clive Davenhall

References

Argyle, R., 1999. Treasure Hunting in Astronomical Plate Archives. *The Observatory*, **119** (no. 1152):269-271.
Griffin, R.E.M., 2001. The Problematic Past. *Astronomy & Geophysics*, **42**(2):25-26

East Asian Archaeoastronomy: Historical Records of Astronomical Observations of China, Japan, and Korea, by Zhentao Xu, David W. Pankenier and Yaotiao Jiang (Gordon and Breach Science Publishers, 2000), ix + 430 pp., ISBN 90-5699-302-X, cloth, £76, 255 × 178 mm.

The materials presented in this book do not reflect the broad field as implied by the book title. The oracle bones is the sole topic that is described more substantially. What astronomical events that are found in the oracle-bone inscriptions, namely solar and lunar eclipses, comets, guest stars, sunspots, auroras borealis, and planets, were chosen as the main topics. Each subject matter is described in a chapter and supplemented with the observed astronomical events in the historical written records of the Far East. This arrangement confines the book to the eight major topics, which only cover a part of the East Asian archaeoastronomy and the astronomical works in the recorded histories of China, Japan, and Korea.

The listings of the observations of solar eclipses, lunar eclipses, sunspots, planets, comets, meteors, and aurora are excellent. These are printed on 217 pages, while the original texts in Chinese characters are given in 133 pages of Appendix I. Yet most of the recorded events had been compiled and published in *Zhongguo gudai tianxiang jilu zongji* (1988) and *Nisshoku gesshoku hoten* (Canon of Solar and Lunar Eclipses) (1979) as mentioned in the book. The materials of the solar and lunar eclipses have been used for the studies of Earth's rotation (also mentioned in the book), and the regression of nodes of the Moon. The book, in Chinese, by Xu Zhentao and Jiang Yaotiao on the study of sunspots is given in the References on p.12, *The Ancient Study of Sunspot in China and Its Modern Application* (1990), and then on p. 152 it is given *as Zhongguo gudai taiyan heizi yanjiu yu xiandai yingyong* (1990).

The lack of a comprehensive bibliography is disturbing. In the References only one work on Japan is given: *Examination of Celestial Records in Japanese Literature* (1986); and one book on Korea: *The History of Korea* (1970). In this reviewed book, it says, "Korean history is subdivided into four distinct periods: the Three Kingdoms, Koryo, and the Yi Dynasty." without mentioning the fourth period. In the text, however, a number of Japanese and Korean works are referred to: *Dai Nihon shi*, *Nihon temmon shiryo*, *Samguk sagi*, *Koyo sa*, *Yijo sillok*, and *Chungbo munhon pigo*.

A glossary of the original Chinese characters for their romanizations in the text is conspicuously missing. This is a handicap for the interested readers who are not familiar with the Chinese language. The usefulness of the "Finding List of Stars and Asterisms" in Appendix II is doubtful, since the only mention of star maps is *The Chinese Sky During the Han: Constellating Stars and Society* (1997). One might find, however, the translated meanings of the Chinese names are of interest.

The authors have brought the comprehensive astronomical events observed in the East Asia, since the early days of recorded histories, in one English-version volume. This is most convenient for those workers in the field of history of sciences, who have no easy accession to other resources on the subject matters, to use. It would also be interesting to persons who like to know some aspects of the historical astronomy in the Far East.

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