

BOOK REVIEWS

Kommandosache "Sonnengott". Geschichte der deutschen Sonnenforschung im Dritten Reich und unter alliierter Besatzung, by Michael P. Seiler (Frankfurt/Main, Verlag Harri Deutsch, 2007; Acta Historica Astronomiae Volume 31), pp. 246, ISBN 978-3-8171-1797-0, €22.80.

Michael Seiler's book contains 230 literature references and 661 footnotes. These form an impressive basis for a comprehensive presentation of the development of German solar physics during World War II, with special emphasis on solar-terrestrial relations. Two eminent scientists, Hans Plendl and Karl-Otto Kiepenheuer, worked closely together to build up a network of solar observation stations for the investigation of a possible connection between solar activity and ionospheric disturbances.

The author presents and summarizes an excellent collection of widely-spread documents, and thus provides good insight into how and why the German Luftwaffe was so interested in installing a network of solar observing facilities. These connections are systematically described in the thirteen chapters of this book, and they are also evaluated from today's viewpoint.

The individual chapters: 1. Prologue: Fundamentals of solar-terrestrial physics; 2. On the initial position of solar-terrestrial physics in Germany in 1939; 3. Origins of military use of solar-terrestrial physics in the Third Reich; 4. "Blitzkrieg": foundation of the first solar observatories of the Luftwaffe; 5. Sun, blood, and soil: occupation, seizure and cooperation in Europe; 6. Total war and mobilization of physics: Office of the Reich for high-frequency research; 7. The role of the Sun is over: "Zermürbungskrieg" and end of war; 8. The military orientation of research 1939–1945; 9. The military benefit of solar terrestrial physics; 10. Collaborations: scientists and Nationalsozialismus; 11. A comparison with the allied efforts 1939–1945; 12. New start and continuity 1945–1949; 13. Epilogue: Persons and institutions after 1949.

Upon reading these titles it is obvious that the book does more than describe the build-up of the individual facilities. Instead, all these activities are put into a larger context and they provide an overview of the relations and connections between the Luftwaffe and solar-terrestrial physics. This view of the historical context is most valuable, since there have already been presentations that concentrate on individual aspects and therefore were not well suited to recognizing the global picture.

The author provides a detailed introduction with information about the source material, especially about those documents that only recently became available and therefore were not used in earlier investigations. This leads to somewhat different conclusions, at least in some cases. The author also points out that documents most probably were destroyed close to the end of the war. A complete picture therefore cannot be established, although some witnesses are still alive and could be interviewed.

The author writes about the motivation for this research: "If the prediction of ionospheric conditions was the justification for the enormous investments in solar-terrestrial physics, what was then the contribution of this research for the radio consultations of the Wehrmacht and what was the real military benefit of the radio consultations for the conduction of the war activities in the Third Reich?"

The ionosphere is located several hundred kilometers above the Earth's surface, it has several layers, and is influenced by solar radiation, especially the ultraviolet wavelengths. The concentration of electrons in the ionosphere depends on the time of day, on the season and on the 11-year activity cycle of the Sun. There are also variations correlated with solar rotation, and solar energetic events may lead to significant changes in the ionosphere.

The state of the ionosphere is very important for radio communication. For long-range communication, the short-wave bands are especially well suited. Frequencies below 30 MHz are reflected in the upper layers of the ionosphere, while higher frequencies penetrate the entire atmosphere. These higher frequencies are nowadays used for radio astronomy and for satellite communication. The frequency limit between reflection and transmittance is variable and depends on the time and the season. Lower layers of the ionosphere also influence the use of radio communication and are subject to disturbances by the varying solar radiation. Solar flares may indeed lead to a complete loss of short-wave communications for hours at a time (Mögel-Dellinger-Effekt). The statistical relations between the influence of the ionosphere on radio communication on one hand and the variability of solar UV radiation on the other were known in the thirties, but not well understood. At this time, Germany did not pay much attention to solar-terrestrial research.

This changed drastically during World War II, especially after German troops occupied large parts of Europe and the air force operated even beyond that area. These circumstances increased the importance of long-range radio communication, and its unreliability due to the variable solar radiation was recognized as a problem. A permanent 'Funkberatung' (Radio consultation) was therefore established in 1939, based at the Air Force Research Center (Erprobungsstelle der Luftwaffe) in Rechlin. Hans Plendl was responsible for this activity. He had obtained his Ph.D. in 1925 with Jonathan Zennecke as supervisor, and he did pioneering work in short-wave communication. He also recognized that permanent monitoring of solar activity was needed if an efficient radio consultation was to be achieved.

In the fall of 1939, Karl-Otto Kiepenheuer joined the Plendl group. He was well prepared for the task of organizing the permanent monitoring of solar activity. He had studied physics in Berlin, received his Ph.D. in coronal physics under the supervision of Max von Laue, and was interested in new technologies. From 1936 on he had been Hans Kienle's scientific assistant in Göttingen.

Michael Seiler describes in great detail how all these solar facilities were established by Kiepenheuer, supported by Plendl and funded by the Luftwaffe. It was only after 1941 that the collaboration between Kiepenheuer and Plendl was put on a contractual basis; Kiepenheuer was not a member of the Luftwaffe, but was on leave from Göttingen Observatory. From 1942 on, the facilities at Wendelstein (Bavaria), Syracuse (Sicily), Zugspitze, Kanzelhöhe (Kärnten) and Schauinsland were put into operation. Besides these, observatories such as Arcetri (Florence), Paris-Meudon, Belgrade and Simeis (Crimea), located in areas occupied by German forces, were included in the observing network.

In 1943, the institute led by Kiepenheuer was moved from Göttingen to Freiburg, with the clear task to deliver data on solar activity that would allow for a forecast of possible disturbances in radio communication. The scientific staff included civilians as well as members of the Air Force. By the end of 1943, the institute that had adopted the name Fraunhofer-Institut, had about 50 staff members (this figure was only reached again in the year 2000). Even in January of 1945, the institute had 22 scientists, and several of those became well-known astronomers in the post-war era.

Seiler's book presents a detailed discussion of the extent to which the solar observations corresponded to the original goal. Were they of importance for the conduct of the war? Did the observation have the character of basic science? Was there any kind of science that could not be used for military purposes? The reader may or may not come to the same conclusions as the author.

At the end of the war, the military-funded network of solar facilities disappeared, but two observatories remained in

operation. Kanzelhöhe Observatory in Kärnten/Austria was assigned to the University of Graz and even today is the only solar observatory in Austria. Meanwhile, the survival of the Fraunhofer-Institut in Freiburg was, in large part, due to the clever use of Kiepenheuer's good personal relations with French and U.S. colleagues. Indeed, he had maintained a fruitful cooperation with his Meudon colleagues throughout the French occupation, and was never a member of the National Socialist party. Soon after the end of the war the Institut was put under the supervision of the French Navy, and it continued to collect and publish data on solar activity. After the establishment of the Federal Republic of Germany in 1949, the Fraunhofer-Institut became part of the federal state Baden (since 1952 unified as Baden-Württemberg). In 1978 the institute was renamed the *Kiepenheuer-Institut für Sonnen-physik*, and it is now a member of the Leibniz Society and is one of the world's leading solar physics institutes.

This book reports on all these complex connections and relations, and many details are analyzed from today's point of view, more than half a century after the end of the war.

We can thoroughly recommend Seiler's book to any reader who is interested in solar physics or seeks information about the relationship between science and the people in power during a 'Total War'.

Wolfgang Mattig and Wolfgang Schmidt
Freiburg i. Br., Germany

***The Stargazer of Hardwicke: the Life and Work of Thomas William Webb*, edited by Janet and Mark Robinson (Gracewing, Leominster, 2006), pp. xix+288, ISBN 0-85244-666-7(hardback), 235 x 156 mm, £14.99.**

The name of the nineteenth century clerical astronomer Thomas William Webb (1806–1885) is still widely known in astronomical circles. Webb was first and foremost a 'man of the cloth', spending the last thirty years of his life as vicar of a small English country parish: Hardwicke, near the Welsh border. However, it is for his assiduous stargazing and popularising of science that Webb is chiefly remembered today. His magnum opus, *Celestial Objects for Common Telescopes*, was first published in 1859 and ran to seven editions (most recently in 1962). *Celestial Objects ...* is still a handy guide to the features of the night sky for amateur astronomers.

As related in the preface to *The Stargazer of Hardwicke*, this book has been a long time in coming. In the decades following Webb's death, the need for a detailed record of his life and work was stressed from time to time, but one hundred and twenty years were to elapse before this hope was realised. Editors Janet and Mark Robinson are to be commended for bringing together a team of writers—both amateur and professional—to give a detailed record of Webb's life and achievements.

This book divides into three main sections. The first four chapters provide an insight into Webb's life: early years and education (M.A. at Oxford); curacies and marriage; his last thirty years spent as vicar of Hardwicke; and an overview of his ministry. Here we can trace Webb's growing interest in science and particularly in astronomy. Chapters 5 to 7 provide a bridge between Webb's life as a cleric and his astronomical work. Especially significant is the discussion by Allan Chapman on the important role played by clerical astronomers in nineteenth and early twentieth century England: men such as Pearson, Perry, Pritchard, Espin and Phillips—in addition to Webb himself. However, it is not until Chapter 8 that the reader encounters a detailed account of Webb's many astronomical activities; this occupies most of the remainder of the book.

In Chapter 8 we find descriptions of Webb's various telescopes: notably his largest instrument—the 9½-inch (23.6 cm) reflector which he used throughout the last two decades of his life. Sadly this historic instrument seems to

have disappeared. Fortunately, as discussed in Chapter 9, Webb's extensive observing notebooks are still preserved. These passed into the hands of his friend and executor, the Reverend Thomas Espin (who revised two editions of *Celestial Objects ...*). Five precious notebooks, described by Espin as "... a model of neatness, patience and care ...", are now preserved in the library of the Royal Astronomical Society.

Details of Webb's numerous observations of the Moon, the planets, comets, the Sun, and double stars—interspersed with examples of his careful drawings—form the basis of Chapters 10 to 14 of *The Stargazer of Hardwicke*. In the final Chapter (15) Bernard Lightman gives an illuminating discussion of Webb's role as a populariser of science: both lecturer and writer.

The book has two valuable appendices: an account of the history and activities of the Webb Society, founded in 1967; and an extensive bibliography of Webb's published works. In addition to his three books (*Celestial Objects for Common Telescopes*, *Optics without Mathematics* and *The Sun: a Familiar Description of his Phaenomena*), approximately two hundred papers are cited—the earliest dating to 1835. Most of Webb's papers were published in popular journals, but he frequently contributed to *Monthly Notices of the Royal Astronomical Society* and *Nature*. He was especially active between 1862 and 1882, sometimes publishing more than ten papers in a single year! Webb's subjects were very varied, covering almost every aspect of contemporary observational astronomy. His particular interest was in double stars, of which he made an exhaustive investigation. Webb continued observing until only two months before his death.

My main criticism of this book is that there tends to be a rather limited continuity in both style and depth of content between chapters—largely because of the number of different authors. Some readers may find this aspect rather distracting. Nevertheless, this book should prove a valuable addition to the annals of leading personalities in science and a tribute to an outstanding observer and educator.

F. Richard Stephenson
Centre for Astronomy, James Cook University,
and Durham University

***The Man Who Found Time. James Hutton and the Discovery of the Earth's Antiquity*, by Jack Repcheck (London, Simon and Schuster Pocket Books, 2004), pp. 247, ISBN 978-07434-5087-8 (paperback), £7.99.**
***James Hutton, the Founder of Modern Geology*, by Donald B. McIntyre and Alan McKirdy (Edinburgh, National Museums of Scotland Publishing Limited, 2001), pp. 51, ISBN 978-1901663-69-3, £8.99.**

James Hutton (1736–1797) is an important figure in the history of science. He was the first to demonstrate from geological observations that the Earth is a body of extreme antiquity, thus inferring a great age for the Sun and for the Solar System. Yet his name is little known outside the world of geologists and historians of the eighteenth century Scottish Enlightenment. Struck by this apparent neglect, Jack Repcheck, an American scientific book editor, was prompted to write an account of the life and work of Hutton whom he regards as one of the great pioneers of science, on a par with Copernicus, Galileo and Darwin.

Hutton lived for most of his life in Edinburgh, in a circle of scholars and independent thinkers that included such luminaries as the economist Adam Smith, the philosopher David Hume and the chemist Joseph Black. Having studied chemistry and medicine at university he went on to become an expert in scientific agriculture and in geology, where he made his mark. His *Theory of the Earth*, published only at the end of his life, postulated cyclical processes that required enormous spans of time to accomplish, and led him to the conclusion that the Earth's duration past and future was

impossible to determine: "... no vestige of a beginning, no prospect of an end." This view differed radically from the favoured one of an evolving Earth with a certain beginning, and it gave rise to prolonged controversy. Hutton's 'deep time' eventually triumphed, and was a key element in Darwin's theory of evolution.

Repcheck tells, with great verve, not only the fascinating story of Hutton's life and work but the entire history of attempts to determine the age of the Earth, from the Council of Nicea in AD 325 to the final result by radioactive dating of meteorites in 1956. He provides a glossary of geological terms, but unfortunately no illustrations—apart from a rather dull map of Great Britain. His occasional sweeping statements such as (in reference to his heroes of science) "Of the four, only Copernicus and perhaps Galileo were Christians ..." or (on the question of calculating the age of the Earth) "Kelvin had a physicist's arrogance ...", may be put down to an excess of enthusiasm for his subject. This apart, he is surely to be thanked for making the achievement of this great pioneer available to the wider public.

James Hutton, the Founder of Modern Geology, is a beautifully-illustrated booklet written by two academic

specialists in Scottish geology. In the compass of fewer than 50 pages they describe Hutton's life and personality, his place in the Scottish Enlightenment and his significance in the development of geological science. Their text is supported by an abundance of coloured illustrations that explain the geological evidence more clearly than any words can convey. These include stunning modern photographs of rock formations in Scotland and also in California, the Grand Canyon and other locations; and samples of meticulous drawings by Hutton's expedition companion John Clerk of Eldin (a member of the same talented family that produced the physicist James Clerk Maxwell in a later generation) to whose memory the book is dedicated. These illustrations alone make the book a delight to peruse. There are also portraits of the two geologists.

These books, preferably both together, supply the answer to anyone wishing to understand how the geologists' long time-scale entered the debate of the Sun's age, a problem which was not solved by astronomers for well over a century.

Mary Brück
Penicuik, Scotland