

Unfortunately, only some of their elegant sketches remain today showing the planet's major albedo features and their changing contrast and color during the opposition. Secchi considered this as definitive proof of seas and continents on Mars displaying seasonal variations rather than atmospheric phenomena and windblown dust as is now known to be the case. In addition to visual observations, Secchi also undertook lunar photography and pioneered spectroscopy of the outer planets.

I found the chapter by Giuseppe Tanzella-Nitti, astronomer, and theologian, "Between Science and Religion: Angelo Secchi and his Time", particularly engaging especially since that issue reached a fever pitch during Secchi's most active years. Following publication of *On the Origin of Species* in 1859 and *The Descent of Man, and Selection in Relation to Sex* in 1871, as Charles Darwin feared, his theories shook the world not just for their biological implications, but for alleging that humans evolved in a similar manner rather than through special creation; a conflict that persists in many quarters to this day. As a deeply religious man but also a consummate scientist and rational thinker, Secchi saw no contradiction between science and religion. To him science and the laws of physics are the tools humans were given by God to help us understand the Universe and life itself. As an adherent to the doctrine of the plurality of (inhabited) worlds, Secchi regarded science not as anti-religion but as the means by which the purpose of creation is revealed to us.

Angelo Secchi is primarily known for his pioneering work in solar and stellar physics and spectroscopy. Two chapters are dedicated to that, Klaus Hentschel's on "Angelo Secchi, Stellar Spectroscopy, Solar Physics, and Visual Science Culture", and Ilaria Ermolli and Marco Ferrucci's on "The Legacy of Angelo Secchi at the Forefront of Solar Physics". Secchi began his stellar classification system around 1860 based entirely on direct-vision spectroscopy, which obviously required a remarkable ability of pattern recognition. Among other things he recognized the absorption lines of carbon in some stars and placed them into a spectral class of their own, now known as carbon stars. In addition to monitoring sunspot numbers and making detailed sketches of their complex structure, Secchi obtained some of the first photographs of the solar corona during the 1860 total eclipse in Spain. Among his most notable contributions to solar astronomy were

regular observations of the chromosphere and prominences in the H $\alpha$  wavelength using an objective prism on his Mertz refractor. To quote from Ermolli and Ferrucci's concluding remarks on page 133:

His (Secchi's) legacy at the forefront of research in these fields lies in understanding the importance of having regular and uninterrupted monitoring of the solar atmosphere and heliosphere ... Solar scientists today continue to build on the full implications of Secchi's studies and methods.

This is a fitting tribute to a remarkable scientist.

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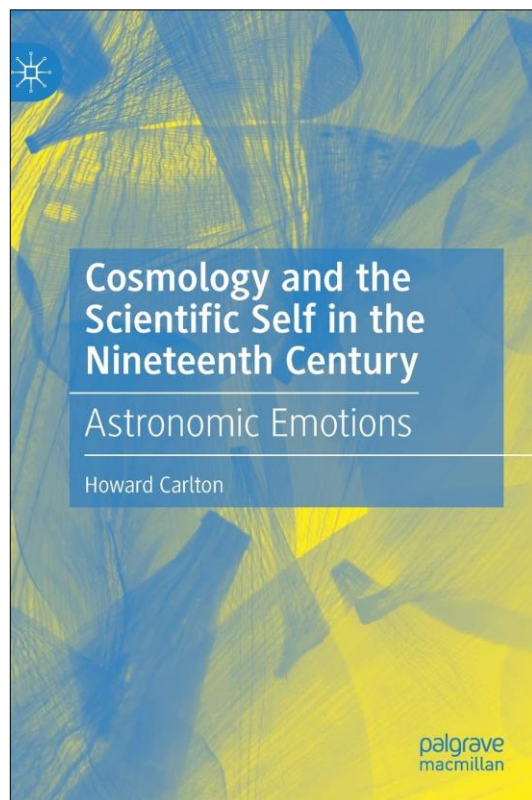
***Cosmology and the Scientific Self in the Nineteenth Century: Astronomic Emotions*, by Howard Carlton (Cham, Palgrave Macmillan, 2022). Pp. xii + 315. ISBN 978-3-031-05280-4 (hardback), 150 × 210 mm, US \$129.99.**

The author of this unusual book, Howard Carlton, turned to the history of science at the University of Birmingham as a lifetime learner after a long career in IT. He initially took an MA in the History of Christianity, reflecting the fact that his father had once been a minister in the Baptist Church, then went on to complete, as a part-time student doing much of his research on nineteenth-century history of astronomy from home, a Ph.D. in history. The present work is based on his dissertation.

The writing of the history of astronomy in the nineteenth century may be said to have begun with Agnes Clerke's publication of her well-known *A Popular History of Astronomy During the Nineteenth Century* in 1885 (which passed through four editions with the last in 1902). Among the numerous highlights are the discovery of Neptune, the first detailed observations and maps of the Moon and planets, the emergence of spectroscopic astronomy and stellar classification, the rise of photography, then photometry, the great transit of Venus expeditions, the first observations with large telescopes of nebulae and debates about cosmogony centered on the Nebular Hypothesis and informed by theories of cosmic evolution, scientifically informed (if premature) attempts to answer the question

of whether there might be extraterrestrial life on the other planets and especially Mars, and the rise of great observatories such as those of Lick, Meudon, and Yerkes are.

All of these topics have given rise to an enormous and increasingly specialized literature, in which hardly a stone has been left unturned in documenting the influences of social, cultural and material factors, even the play of subjective factors as in the recognition of the irreducibility of the personal equation and the influence of perceptual factors in visual observations especially of the planets. As suggested by Carleton's bibliography, the



number of sources of information is formidable; few, except professional historians who tend to talk mostly to each other (and perhaps sometimes to God), can have read or digested more than a small part of this voluminous literature.

Carleton's claim to originality is in trying to link the ideas of astronomers and physicists on such potentially emotion-laden and religiously intertwined topics as those of extraterrestrial life in the Universe, the nebular hypothesis, and the ages of the Sun and Earth to the researchers' 'subjectivities'—especially the significant impact of traumas including the loss to early death of children (a not uncommon occurrence during the Victorian era when child mortality was huge, and which affected many individuals, including Charles Darwin and the Third Earl of Rosse

at significant points in their careers and influenced their attitudes toward religion). Further traumas include the mental crises that used to be called nervous breakdowns, the mind-bending effects of drugs—especially opiates—which were widely consumed and could affect one's perceptions of time and space. This is a promising vein—and corresponds to what Carleton somewhat ploddingly describes as the subjects' *Weltenmodell* (by which he signifies not a 'world model' as the literal translation suggests but the "... internally felt or experienced worldview ...", as opposed to *Weltanschauung* (worldview) which he uses to refer to the objective and rational perspectives. At least in Victorian times, the objective and rational perspectives (what Freud and his colleagues would later discuss in terms of defense mechanisms, rationalizations, reaction-formation and neurotic personality development) are often well-documented in publications of the era; one can usually surmise the underlying emotional substrates, since often these are expressed in the subjects' religious commitments (which are either deep-seated and unchangeable or rather superficial and easily cast aside), or from personal writings such as letters and diaries. To his credit, Carleton does a fair amount of sleuthing in the latter, and he does manage to suggest that these less-well-documented private events including losses and grief led in at least some cases—like that of Richard A. Proctor and John Pringle Nichol, in both of whom, incidentally, religious commitments seem to have been rather weak and tentative—to significant restructuring of personality, career developments, and ultimately to rethought convictions about astronomical theories. This line of argument occurs like a leitmotif in Carleton's text though somewhat sporadically and incidentally at times.

I think his conclusion is inescapable, though, that there are marked connections between people's private experiences and inner world of emotions and their assessment of the plausibility or otherwise of scientific positions—and though in Victorian times, the influence of establishment religion and dogmatic religion and even fundamentalist views concerning the literal truth of the Bible ran strongly against the tide of what often seemed shocking scientific advances, this remains the case today.

One of the things implied but not stated in Carleton's book is that in fact religious affiliation (or a lack of it) tends to be determined to a large extent by emotions—i.e., in the realm of Carleton's *Weltenmodell*. And so even at the present time, one third of Ameri-

cans believe that humans have always existed in their present form. Evangelical Christianity in the United States has placed individuals who subscribe to the literal truth of Genesis and a 6,000 year old Earth in the highest levels of Government (including positions such as Secretary of State and Speaker of the House), while the Catholic Church remains a force of reaction as it has always been, and in the nineteenth century emphatically became after Pius IX—with whom the astronomer Angelo Secchi somehow managed to stay on good terms—declared a war on modern ideas, which continues hardly at all abated.

So rather than being primarily a book about the ‘scientific self’, Carleton’s book must be taken largely as a history of the interactions of the two epistemologies, the competing magisteria of science and religion, which sometimes, in some figures, attained a perhaps only metastable rapprochement, and in others led to a decision that they were irreducibly separate and could not be reconciled. Richard Proctor is one of the most interesting cases Carleton describes. As he notes, Proctor emerged from several years of attempted conformity to Catholicism—an embrace which owed much to an interfaith marriage with an Irish Catholic woman, grief at the death of a child, and financial reverses—not least because he was told that some of his astronomical theories did not conform to the teachings of the Church. Carleton writes:

Proctor accepted that the universe was shaped by the action of secondary laws including Darwinian evolution, a position clearly at odds with the Creationist beliefs of the Catholic Church, he now claimed that it was possible to divorce science from religion entirely. ‘So far as Science is concerned, the idea of a personal god is inconceivable.’ (page 128).

Instead, he became an agnostic, in which his position was (page 121), “... we don’t know, we won’t know.” He still held to the belief in something—a Mystery of Mysteries, which Herbert Spencer described as the ‘Unknowable’—but there was scant comfort in that; the Unknowable was—like the number zero—a placeholder for those not possessed of enough of the ability to sit in uncertainty which the poet Keats (in a letter to George and Tom Keats, 21–27 December 1817) described as “negative capability ... [and the ability to accept] uncertainties, mysteries, doubts, without any irritable reaching after fact and reason.” Proctor’s friend Edward

Clodd, who struggled with reconciling the two competing magisteria of science and religion, put it well (quoted on page 128):

A long time was to pass ere I came to see that there is no half-way house between Catholicism and Agnosticism, and that the intermediate beliefs lacked the authority which has the glamour of antiquity and the audacious assumption of finality.

In terms of structure, *Cosmology and the Scientific Self in the Nineteenth Century* begins with a rather plodding introduction that crams everything but the kitchen sink in terms of rehearsing all the scholarly works remotely connected to his thesis; it is a hard slog, and I must admit that I almost gave up on the book at this point and threw it in the bin. Once he gets to the meat of the book—the case studies involving extraterrestrial life debates, cosmogony, and the ages of Earth and the Sun—I found much to admire. In particular, Carleton’s discussion of Proctor offered much that was new to me, while the debate over the nebular hypothesis, climaxing with the apparent resolution of the nebulae by Robinson and Rosse with the *Leviathan* of Parsonstown, was a page-turner, and though the subject has been widely treated before, here Carleton’s *Weltenfall* approach was particularly aptly invoked and offered new and convincing perspectives. I will keep his book close to me on the shelf as a reference and model whenever in future I have to write about that topic.

Because he wrote the book as a PhD in history, Carleton’s discussion of the internal motivations of his subjects is somewhat limited by the nineteenth-century Victorian perspective on such issues; there was as yet no such thing as depth-psychology, and the understanding of neurological, neurophysiological, and psychological processes was primitive (Wilhelm Wundt’s lab for experimental psychology was founded at Leipzig only in 1879, while William James’ influential *Principles of Psychology* was published in 1890 and Freud’s *Interpretation of Dreams* in 1900). The raw materials of Carleton’s book would likely serve richly as a basis for psychoanalytic – or at least psychological – interpretations. He also would likely have made good use of the neurocognitive differences of individuals in his attempts to elucidate the fluctuating (or steady) commitments of his subjects to various scientific and/or religious ideas. As noted by Amodio et al. (2007), liberals and conservatives differ in the error-related negativity (ERN) spike in



brain activity in the anterior cingulate cortex, which serves as a kind of internal alert system within the brain signaling when a mistake has been made (an anomaly is perceived). Liberals tend to have heightened ERN, indicating a cognitive system that acknowledges the need for adjustments in perspective and strategy. On the other hand, conservatives exhibit a small ERN, which suggests their cognitive system is more resistant to signals advocating change or reconsideration. This suggests a neural reflection of their preference for stability, tradition and consistency. One can speculate on which of the figures Carleton describes would have had heightened ERN (Nichol, Proctor) and who would have had small ERN (Whewell, Robinson).

I would add, finally, that to a greater extent than many scientists would admit, their commitments to certain ideas owe more to their emotional than strictly rational belief systems. For example: term *L* in the Drake Equation, which denotes the length of time technological civilizations send communications into space, seems to be the most important in determining the prevalence of extraterrestrial civilizations in the Galaxy (or Universe). If the term is 1,000,000 years, there should be scads of ETs out there sending signals; but if it is 10,000 years or less, virtually none. Whether one believes the first or second scenario to be more probable depends largely on whether one is optimistic or pessimistic about humans' survivability as a species; this in turn has to some degree an emotional component, and ties in with whether one believes that we can (collectively) learn from experience and adjust or whether we are doomed to enact forever (or at least until extinction) primitive instinctive patterns of behaviors such as religious tribalisms, tendencies to emphasize short-term unsustainable developments over long-term stability, and above all a propensity to see violence (toward others) as a viable solution to our problems.

### References

Amodio, D.M., et al., 2007. Neurocognitive correlates of liberalism and conservatism. *Nature Neuroscience*, 10(10), 1246–1247.

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***Chronicling the Golden Age of Astronomy: A History of Visual Observing from Harriot to Moore*, by Neil English. (Cham, Springer, 2018). Pp. xiv + 665. ISBN 978-3-**

**319-97706-5 (hardcover), 164 mm × 241 mm, EUR 246.09.**

The Scot, Neil English, has a BSc Hons. in astronomy and physics and a PhD in biochemistry. The author's academic background, the publication in the renowned Springer series 'Historical and Cultural Astronomy', and the book's large size (and high price!) suggest a higher level of scholarship compared to his previous ones, mainly treating amateur astronomical topics. The table of contents, representing over 450 years of celestial observation, confirms this. On the back cover we read: "Generously illustrated throughout, this treasure trove of astronomical history shows how the work of each observer led to groundbreaking developments in science and provides important insights into the way we explore the heavens today." Does the author live up to this high standard?

The focus of the book is on the history of the telescope, its skilled constructors and keen observers. Of course, the author also treats other fields, like photography, meteors, space flight or even ET. Both amateurs and professionals are featured, the latter often having started astronomy as a hobby, using small instruments before moving on to an observatory. We meet many big names, but also rather unknown observers. Overall, the result is an interesting mix of characters, objects, instruments and methods. The theme is presented in an easy-to-understand manner and at first glance appears to be well researched. You can tell that the author is an experienced visual observer with a profound knowledge of instruments. The reader does not have to be a specialist in astronomy and its history. Is all that money well spent?

The hardcover book has an impressive 679 pages. The table of contents is a chain of 41 chapters. However, it would have been more user-friendly to divide it into several sections. The book shows 84 black/white and 182 color images (some made by the author), although not of consistently good quality. The layout and presentation are convincing. However, the fluently written text often reflects the author's personal opinion—you don't have to agree with everything here. Six chapters are introduced by a quote from a prominent person; all end with a list of sources: books, articles and links (some are pretty long). The Appendix presents a timeline, headed "Achievements of the Classical Refractor", listing 43 important events between 1733 and 2016. The book has a relatively short Index in relation to its size. Many names and topics that appear in the text are missing. You can