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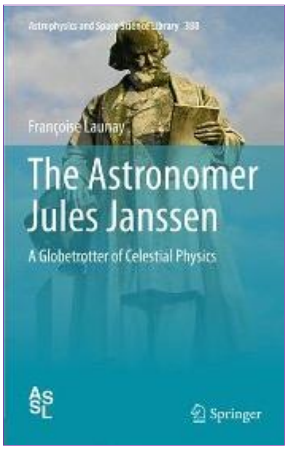
BOOK REVIEWS

***The Astronomer Jules Janssen: A Globetrotter of Celestial Physics*, by Françoise Launay (New York, Springer, 2012). Pp. xxii + 220. ISBN 978-1-4614-0696-9 (hard cover), 160 × 242 mm, US$99.00, €83.29, £72.00.**



For me, Jules Janssen has long been a favourite figure in the history of solar physics, so it is a great pleasure to review this entertaining and copiously-illustrated biography, penned by the Paris Observatory astronomer Françoise Launay. This is a timely English translation (courtesy Storm Dunlop) of the original French edition—which I enjoyed reading when it first appeared—but Janssen is too important a figure to be shared only by those who read French, so I am delighted that this English edition has been published. All credit to Springer, for keeping us supplied with a variety of new books on astronomical history. But I digress …

Pierre Jules César Janssen—better known simply as Jules Janssen—was born in Paris on 22 February 1824, and after a long and adventurous life died in Meudon on 23 December 1907. His parents intended that young Jules should pursue a career in painting, but fortunately history decreed otherwise and astronomy gained a champion. Yet his obvious artistic talent shines through in Launay's well-illustrated book, which contains five different pencil portraits sketched by Janssen.

Because of my own particular research interests I have always held Janssen in high esteem for four 'crowning achievements' and the first of these relates to his observations during and immediately after the total solar eclipse of 18 August 1868, while based at Guntoor in India. Thanks in part to the presence of an enormous prominence, which the British party also sited at Guntoor referred to as 'The Great Horn', Janssen was able to use spectroscopic observations to determine its chemical composition, but more importantly, he devised a method of successfully observing prominences at times when there was no eclipse. The British astronomer, Norman Lockyer, also came up with the same idea quite independently, and this major breakthrough in solar physics is discussed by Launay in Chapter 4.

Janssen may be famous because of the 1868 eclipse, but he was far from inactive during his next visit to India just three years later, for the total solar eclipse of 12 December 1871. As Launay explains:

> It is thus easier to appreciate the efficiency of Janssen who did everything: overall visual observation with one eye, spectroscopic observation with the other, and who took the time to make a drawing, to admire, to dream, to record everything in his head, and who still had a few seconds to make polarimetric observations! (p. 67).

Chapter 6 is devoted to this eclipse.

To my mind, Janssen's second 'crowning achievement' was his invention of the 'revolver photographique', which was used to take multiple images of the 1874 transit of Venus. The French sent out six expeditions to observe this transit, and Janssen led the one destined for Nagasaki in Japan. The saga of this successful expedition is discussed by Launay in Chapter 7.

The following chapter is devoted to another of the 'crowning achievements' I refer to above in that it recounts Janssen's key role in the founding and early development of the Meudon Observatory, with what at the time was the second-largest refracting telescope in the world, and an excellent short-focal length (f/3) 1-m aperture reflector. This was France's first facility set up solely to address the research challenges of 'The New Astronomy', and in this chapter Launay refers to it as the "Paris Observatory for Physical Astronomy". Janssen, then aged 51, was appointed its founding Director, even though

> He was a graduate of neither the École normale supérieure nor the Polytechnique and, until then, had only held temporary assignments from the state. He finally saw the outcome of 18 years of research in the service of science ... (p. 93).

Chapter 9, which follows, just happens to discuss the fourth and final 'crowning achievement', Janssen's accomplishments in astronomical photography. He is justly famous for his 1877 and 1885 images of solar granulation, and for obtaining the first successful photograph of the head *and* tail of a comet, namely Comet C/1881 K1 (Tebbutt) in 1881 (see Orchiston, 1999 for details). Despite his penchant for spectroscopy, Janssen also realised the future potential of photography when applied to astronomy, so it is little wonder that "... he created, without delay, a department for celestial photography ..." at Meudon (p. 113).

The subtitle of this book, *A Globetrotter of Celestial Physics*, certainly portrays Janssen's peripatetic existence, achieved—we must remember—in an era prior to international air travel. Solar eclipses took him to Italy, India (twice), Algeria, Siam (present-day Thailand), the Caroline Islands (in the Pacific) and Spain, while the 1874 and 1882 transits of Venus saw him in Japan and Algeria. In order to carry out terrestrial or celestial spectroscopic observations he visited the Bernese Alps, Italy and Lake Geneva. On other occasions, astronomy also saw him visiting or passing through Austria, the Azores, Ceylon, England, Germany, Greece, Hawaii, Hong Kong, Ireland, Italy, the Marquesas Islands, Panama, Peru, Portugal, Scotland, Singapore, Spain, Switzerland and the USA.

While the subtitle of Launay's book may highlight Janssen's extensive travels, it does not quite capture his somewhat adventurous—and even at times life-threatening—existence. While in Peru in 1857, on his very first overseas journey, to help pinpoint the magnetic equator, he fell seriously ill with "… dysentery, intermittent fevers and hepatitis …" (p. 14), and it was more than six months before he was well enough to return to France. Meanwhile, getting to the Algerian eclipse of December 1870 posed a special problem because the Franco-Prussian War was raging at the time and Paris was under siege. Although his British friends arranged safe passage for him through enemy lines, Janssen decided instead to escape by balloon. There were no balloonists available and although he had never piloted a balloon

> … I did not feel I should let myself be stopped by this difficulty, and, being convinced that theoretical knowledge, carefully acquired, and experience in travel would suffice to give me the confidence and the necessary inspiration to control my aerostat properly, I undertook its supervision. (p. 90).

Needless to say, he made a successful escape.

Speaking of danger, Janssen had a strong affinity for mountains, especially if they happened to be volcanic. In 1864 he ventured to the summit of the Faulhorn in the Bernese Alps to observe the solar spectrum from nearly 3,000 metres. Three years later he was atop Mount Etna in Sicily for three days, then he went to Santorini in Greece to carry out dangerous observations of the magnetic field at an active volcano and of the spectrum of the gases emitted by it. After observing the 1868 solar eclipse in India he spent three months in the Himalayas. In 1883, after observing yet another total solar eclipse, he visited Hawaii and spent a night conducting research in the crater of Kilauea.

But Janssen's major alpine achievement, surely, was the establishment of an astronomical observatory on the summit of Mont Blanc at 4,810 metres. In 1890, when Janssen was 66 and could not walk too freely let alone conquer France's highest peak, he had to be carried up and down the mountain, first on a 'ladder-chair' that he designed especially for the occasion, and at the higher altitudes on a sledge. This was Janssen's first ascent of Mont Blanc and immediately convinced him that his Meudon observatory should establish a branch observatory there, well above much of the oxygen and water vapour in the Earth's atmosphere. This ambitious endeavour came to fruition towards the end of 1893, when Janssen made his second visit to the summit. His third conquest of the summit occurred two years later, when Janssen was 71 years of age, and he oversaw the installation of a polar refractor with an objective 30 cm in diameter. Meudon could now boast a flourishing high altitude observing station, and Launay devotes all of Chapter 12 to it, complete with a wonderful array of illustrations. This iconic observatory was built on consolidated ice, not on bedrock, and it was only demolished in 1909, two years after Janssen's death, when it was no longer safe.

Janssen's final encounter with mountains occurred in 1904, just three years before his death, when he was carried to the summit of Mount Vesuvius in a sedan chair. When they arrived Vesuvius was active, ejecting lapilli and volcanic bombs, and they were lucky not to be hit. The guides wanted to descend immediately but Janssen refused to allow this until he had taken photographs and collected samples. This was typical Janssen ... determined, and totally committed to science, right to the end.

One of the things that comes through strongly in Launay's book is that Janssen was a 'people's person' and made friends easily. In astronomy, for instance, he formed close life-long friendships with the noted British astronomers, Warren De La Rue, William Huggins and Norman Lockyer, and had a special affection for British astronomy. There were only two astronomers of note he did not get along with at all: the Italian spectroscopic expert, Father Angelo Secchi, and his French colleague, Henri Deslandres, who eventually succeeded him as Director of the Meudon Observatory. Delandres' exchanges with Janssen at a staff meeting on 28 July 1906 make interesting reading (see pp. 195-196), and after Janssen's death, Deslandres continued to make life difficult for Mrs Janssen and her daughter.

A number of topics in this fascinating book took me by surprise. For instance, although he only ever enjoyed one balloon trip, for Janssen "... this represented the beginning of a sustained and visionary interest in aeronautics." (p. 56), and he was elected the inaugural Chairman of the Société française de navigation aérienne in 1873. His long and intimate involvement with 'aerostats' is recounted by Launay on pp. 56-61, including the first use of balloons for high altitude astronomical observations.

I also was surprised to read how impressed Janssen was with Edison's famous invention, the phonograph. Indeed, Launay assigns an entire short chapter (pp. 137-142) to this.

Janssen was closely involved with the (French) Académie des Sciences, L'Association Française pour l'Avancement des Sciences, the Société Française de Photographie (as a one-time President), the Société Astronomique de France (also as a one-time President), and even the British Association for the Advancement of Science, but perhaps I should not have been surprised given his diverse interests that he also felt equally at home in non-scientific circles. Janssen was a brilliant public speaker, and as portrayed in Chapters 13 and 14, he frequented Madame Adam's literary salon, and was active in the French Alpine Club (also as a one-time President), the Académie Française, the Société Philomathique, the Société de Géographie (yet again as a one-time President) and the Marmite, an interesting republican society of which he also at one time was President. He counted among his closest non-astronomical friends various politicians, Gustave Eiffel and the noted painter, Jean-Jacques Henner.

One paragraph in Launay's book truly amazed me:

> Janssen did not write any original work, and this has certainly contributed to his neglect during the twentieth century. His scientific publications are in the form of reports, certainly many of them, but rather short, published either in the Académie des sciences, or in the journals of the learned societies before whom he had given papers ... (p. 186).

Wrongly, it would seem, I had assumed that he was a prolific publisher of research papers, in keeping with his impressive research portfolio.

Finally, I have to say that I was touched by Janssen's obvious affection for his (normally) ever-patient Henriette, who spent far too many weeks, not to mention months, at home alone while her husband happily toured the globe all but wedded to astronomy! Yet theirs was a deep loving relationship, as evidenced by some of Jules' letters to Henriette that Launay reproduces throughout the book, and his true feelings for her were very apparent in 1883 at a meeting in Vienna. There, rather than graciously accepting Palisa's offer to name a new minor planet after him, Jules instead assigns it to his beloved wife:

> ... as a consequence, I begged the gathering to accept the name of Henrietta, by which Madame Janssen was baptized. Everyone cheered your name, and everyone returned to congratulate me or rather, to beg me to pass on their congratulations to you. (p. 128).

This long and detailed review reflects my admiration for Françoise Launay in assembling a book on one of the great names in French astronomy. She has managed to pack a great deal of interesting information into a mere 220 pages, the last 20 of which contain a Janssen 'Chronology', a 'Bibliography' and a 'Name Index'. All that is missing is a Subject Index! Nonetheless, *The Astronomer Jules Janssen* ... is well researched and well written. It is easy—at times captivating—reading, and is sprinkled with 78 figures. This very reasonably-priced book is a 'must' for anyone interested in French astronomy, or the history of astrophysics or solar physics, but in fact it deserves a much wider audience.

References

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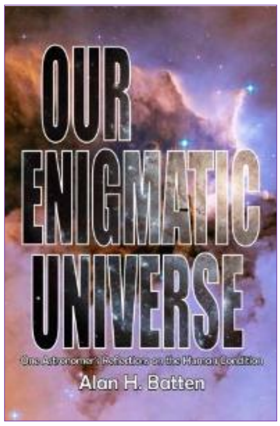
***Our Enigmatic Universe: One Astronomer's Reflections on the Human Condition*, by Alan Batten (Ely, Melrose Books, 2011). Pp. xiv + 205. ISBN 978 1 907732 03 4 (paperback), 156 × 234 mm, £8.99.**



The reader who picks up this book expecting to learn the latest on the structure and content of the Universe may feel slightly misled by the title. The book does touch on a wide range of topics, which (if we put cosmology as such aside) include: Darwinian evolution, God, religion, genetics, the brain, Newtonian gravity, the Solar System, Bayesian probability, Intelligent Design and many more. A better guide to the contents is the book's subtitle. Alan Batten is an astronomer and an active Christian (he has served on the Synod of the Anglican Diocese of British Columbia). He argues that "… it is quite rational for one to be open to the idea that the world contains entities that transcend our senses." (p. 24), and questions Francis Crick's contention that "… our thoughts and hopes and wishes [are] … 'nothing but a pack of neurons.'" (p. xii).

The book's ten chapters (with such titles as, "How we perceive the universe", "Belief in God" and "Reason and revelation") are wide ranging in the topics they touch upon, although certain themes are recurrent. The—very useful—Name Index provides an indication of which people have most strongly influenced the book's central argument. Apart from God (He is mentioned more than anyone else), Charles Darwin's name appears most often, followed by the astronomer Arthur Eddington. A bit less frequently we come across the physicists Albert Einstein and Isaac Newton, the philosopher Bertrand Russell and the evolutionary biologist Richard Dawkins. Only Dawkins is still active; the other five have been dead for over forty years (Newton for almost three centuries). While I wouldn't make too much of this simple name-counting, it does show how the book has been at least as much driven by contemplating human evolution as by considering cosmology.

By tracing the flow of topics and arguments in one chapter, the reader can perhaps gain an impression of how the book makes its case. Chapter 4, "Argument from design," begins with Thomas Aquinas' five arguments for the existence of God. The last – God as designer – is, notes Batten, an ancient argument. Newton could explain the motions of the bodies in the Solar System, but could not account for the fact that the planets orbit the Sun in almost the same plane. In this he saw the hand of God. But Laplace, a century later, would explain the planetary configuration in the context of his nebular cosmogony, concluding that he had "… no need for God." This, notes the author, illustrates the danger of invoking God to plug gaps in our understanding. One could then counter that God is still present as He laid down the laws later discovered by Newton, Laplace, et al., but this is the aloof Aristotelian godhead, not the Christian God of love. By the twentieth century, man, the Earth, even the Sun, are no longer central in the Universe, and with Darwinian evolution (and Freud's ideas about the mind) we have a "… principle of mediocrity." Via a Universe with special properties (one with niches fit for life) we arrive at the anthropic principle. In a multiplicity of Universes —running parallel—we only exist in the one(s) suitable for us. This brings up the idea of the multiverse (a relatively modern concept in cosmology), the existence of which is said to be compatible with belief in God (R. Collins) or can be seen as a form of deism (P. Davies). The testability of multiverse theory has been questioned, and if untestable, then it falls outside the realm of science. After considering recent ideas about Young's two-slit experiment, the author puts forward the explanation for the existence of life that he favours, "… the universe was created with the deliberate intention that intelligent self-aware life should emerge." The argument then proceeds via "design" in biology, fixity of species, evolution, natural selection, genetics, to Intelligent Design, in particular the perceived impossibility of organs (like the eye) and processes (blood clotting) to have arisen by natural selection. Finally, after touching on other homeostatic systems, the mind, the effect organisms have on their environment (and vice versa), the chapter's conclusion is that design arguments ultimately fail to prove God's existence.

As I noted at the beginning, the book is not really about the cosmological Universe. Modern cosmology and the evolution of the Universe do turn up occasionally (as in the brief consideration of multiverses in Chapter 4). Early in the book there is some discussion (p. 3) of the Big Bang and Steady State models, but there is no reference to the microwave background or to its tiny irregularities, although brief mention is made of today's enigmas of cosmology: what is the nature of dark matter, and what is dark energy. For its central argument the book refers to other astronomical topics (to the extent that they are invoked at all) than cosmology.

The text is clearly written—Batten has a pleasant, easy to read prose style. I particularly admire his objectivity while navigating controversial subject matter. He has a point of view, as noted above, but has no axe to grind, and clearly points out the strong and weak arguments put forward on all sides. He has consulted a huge body of literature—if only as a guide to those writings the book is of interest. The short Subject Index is valuable, but would have been more so if it had been somewhat expanded.

To sum up (though that is difficult to do in such a wide-ranging book), I quote from a passage near the end (p. 195):

> In essence, theism is the belief that the power that sustains this enigmatic universe is also the source of life, and that we can have a relationship with that power that is analogous to the most intense relationships that we enjoy with our fellow human beings. Some people may find that hard to believe, or even unnecessary, but after a lifetime spent in scientific research, I do not know of any result that compels us to abandon the belief.

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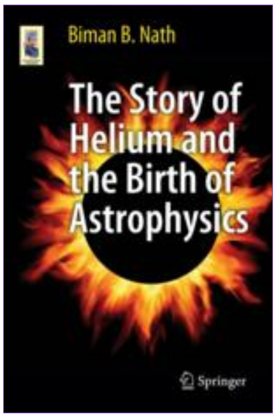
The Story of Helium and the Birth of Astrophysics, by Biman B. Nath (New York, Springer, 2013). Pp. xii + 274. ISBN 978-1-4614-5362-8 (paperback), 151 × 235 mm, €39.96.

This is a badly-needed book, for as the author, Indian astrophysicist Biman Nath, points out,

> The most interesting—in fact the most singular—aspect of its [helium's] discovery story is that it is largely forgotten … What has remained in our collective memory, and on the pages of history books, is a distorted story, in which the chronology of events has been all jumbled up, and in which some scientists have been given wrong credits while some other names have been unceremoniously left out ... (pp. 4-5).

First Nath 'sets the scene', as it were by providing background information about helium in Chapter 1, which is titled "The Unbearable Lightness of a

'Noble' Element", while early concepts of elements and the development of chemistry are in a short second chapter.



The following four chapters provide a summary of early developments in astronomical spectroscopy, and highlight the major achievements of all of the key 'players' through to the 1860s. Thus we encounter all-too-familiar names, like Brewster, Bunsen, Foucault, Fraunhofer, John Herschel, Huggins, Janssen, Kirchhoff, Lockyer, Miller, Rutherfurd, Secchi, Talbot and Wollaston, but not in that order. This is well-trodden turf for those familiar with the history of astronomical spectroscopy, and is covered in far more detail in Hearnshaw's classic *The Analysis of Starlight* … (1986), while parts of the story appear in individual books and major review papers on some of these astronomers. However, Nath does provide a useful 'refresher course', and he makes very effective use of quotations taken from nineteenth century published sources.

So we come to Chapter 7, titled "James F. Tennant, Soldier Turned Astronomer" and to the total solar eclipse of 18 August 1868, which has already been mentioned in passing in several of the previous chapters given its critical role in the discovery and identification of helium. In fact Tennant played very little part in the 'helium' story, but it was his lobbying and that of Edmund Weiss that draw widespread attention to the 1868 eclipse, the fact that the maximum duration of totality would be an extraordinary 6 minutes and 50 seconds, and that the path of totality would pass through Aden, India, Siam (Thailand), Borneo, New Guinea and the New Hebrides, thus offering many potential observing sites. The British decided to mount an expedition, led by Tennant and sited at Guntur. Norman Pogson, the new Director of the Madras Observatory, also decided to arrange a separate expedition, and Nath devotes the rest of this chapter to the preparations that he and Tennant made. Pogson would be based at the coastal port of Masulipatam, and Tennant a little inland, at Guntur. Janssen also selected Guntur for his observing site, and Chapter 8 summarizes the final preparations of all three.

Chapter 9, titled "The Perpetual Eclipse of 1868", includes accounts of the observations of the eclipse made by the various Indian-based observers. Here is where the story of the discovery of helium begins: during totality when they looked at the spectra of the prominences Janssen, Tennant and Pogson all saw a conspicuous bright emission line in the yellow, but while Janssen and Tennant attributed this to the D-line of sodium, Pogson was not sure that its position coincided exactly. The remainder of this chapter deals mainly with polarization observations of the corona, and Janssen's momentous discovery that he could observe the spectra of the prominences on the days following the eclipse. And so the concept of the spectrohelioscope was born.

By a strange coincidence, Norman Lockyer had conceived the idea of observing the spectra of prominences outside of eclipses nearly two years earlier, but delays in the completion of his spectroscope meant he only was able to make the critical observations in October 1868, two months after Janssen. Nevertheless, letters about their discoveries from Janssen and Lockyer reached the French Academy of Sciences at the same time and were read at the same meeting. In 1872 a medal was struck by the French Ministry of Public Instruction assigning equal credit for the discovery to both men. All this is recounted by Nath in Chapter 10.

However, this fascinating Chapter contains even more, for it reports Lockyer's discovery, on 6 November 1868, of the chromosphere (which was then confirmed by Janssen), and it deals also with the identification of the anomalous bright yellow spectral line queried by Pogson. On 15 November 1868 Lockyer was convinced that this line was not due to sodium, while Janssen reached the same conclusion in mid-December. So here was a new line in the solar spectrum, and its identification occupies the remainder of Chapter 10 and all of Chapter 11 ("The Ghost Element that Refused to be Identified"). Lockyer decided to name it helium, but only in 1895 was it finally detected in the laboratory by William Ramsay, bringing to an end nearly thirty years of confusion and controversy (see especially pages 230-240 in Chapter 12, "Helium on Earth").

The Story of Helium is Nath's first history of astronomy book, but I hope it will not be his last (although more careful proof-reading of future manuscripts should eliminate many of the 'typos' that appear in this book). Nath has an easy writing style, and reading the text is a little like reading a detective novel—except that in this instance fact surely is stranger than fiction!

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