The British Astronomical Association
Historical Section

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From the Director
Mike Frost

I will start with the unfortunate news that there will not be a section meeting this year. The deputy director and I spent much of the year wondering if we would be able to hold a real-world meeting, as we had intended to do in 2020, however in the end we felt that the time was not yet right. So, instead, I was hoping to hold a webinar similar to our lecture last November by Dr Geoff Belknap. Unfortunately, none of the people I approached were able to take part in a webinar. I detected an element of Zoom-fatigue amongst some potential speakers - and having lectured to my laptop many times this year, I can appreciate why! Furthermore, I am now back in Chicago, and likely to be working flat out there on my day job (engineering) for the next couple of months. The upshot – we will postpose the section meeting into 2022, with the sincere hope that we can run a real-world event where we can meet in person again. Wouldn't that be good?!
My apologies for not being able to run something this year.

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Something else I haven't quite managed to complete before travelling to the United States is to finish off reading a birthday present – a copy of the recently published "Neptune: From a Grand Discovery to a World Revealed: Essays on the 200th Anniversary of the birth of John Couch Adams" (ed. William Sheehan, Trudy E. Bell, Carolyn Kennett and Robert Smith). If I had managed to complete the last couple of chapters, I would have put a review into this newsletter, but instead I'll write something a little less formal here.
The story of the discovery of Neptune has always fascinated me, and I suspect many of you too. With the re-emergence and re-evaluation of the RGO's "Neptune files" in recent years, the time is ripe for a scholarly overview, which this book provides. John Couch Adams, of course, was the English scholar who predicted the existence and location of a planet beyond Uranus but was beaten to the discovery of Neptune by the French astronomer Urbain Leverrier.
The essay format allows experts in many different aspects of the Neptune discovery story to give their personal perspectives. Carolyn Kennett and Brian Sheen detail Adams's

family history and early life in Cornwall; James Lequeux tells Leverrier's story; Davor Krajnovic provides a much-needed overview of the oft-overlooked German side of the story; Robert Smith and Richard Baum (with one of his final contributions to astronomical history) consider William Lassell and his discovery of Triton, and the retracted "discovery" of a Neptunian ring.

Of course, the sections that mean most to me are those that I can relate to personally. Bill Sheehan writes about John Couch Adams's career at Cambridge University. He details the mathematics tripos of the early 19th century and the ferocious annual competition to become senior wrangler, top scorer in the undergraduate examinations. Likely candidates for senior wrangler underwent exhaustive and exhausting private tutoring. The tripos results, a listing of first, second, third … wrangler in descending order, were a matter of national interest. It was a system that produced John Herschel (Senior Wrangler, 1813), George Biddell Airy (1823), James Challis (1825), Gabriel Stokes (1841), Arthur Cayley (1842), John Strutt, later Lord Rayleigh (1865), and many other leading figures of nineteenth-century British science.

I was also a Cambridge mathematician. I can assure you that the tripos exams remain fiercely competitive, though no longer a subject for discussion in the national newspapers (although the results were still published there in my day). Many of the Victorian traditions still persist – Cambridge mathematics graduates do not receive first-, second- or third-class degrees; rather they are classified as wrangler (first class), senior optime (second class) or junior optime (third class). Note there is no 2.1 / 2.2 divide, as happens in every other course in a British university. This was of importance to me! I'd love to be able to tell you that I was in strong competition to be senior wrangler of 1984, but the truth is that I was a journeyman mathematician who did too much marathon running, and so I was classified a senior optime. The order in which everyone finished was not officially published, but everyone knew it, and so I can reveal that I was around 70th place (from memory: I can't remember the exact number) with a wrangler cutoff around 55th place. So, I was close, but not too close, to a first-class degree. I can't say I was cheated. The lack of a 2.1 / 2.2 divide made application for post-grad degrees a little more complicated, as a 2.1 is normally required, but Sussex University took me on to their M.Sc Astronomy course, and I've written in previous newsletters about how much I loved that course. I loved Cambridge maths too. And senior optime was good enough for Annie Maunder (1889), so I'm in good company.

Of course, I was also interested in astronomy during my Cambridge days. I was a member of the Cambridge University Astronomical Society, CUAS. Among the telescopes CUAS used for observation was the Northumberland Refractor, the very telescope with which James Challis undertook to look for the new planet which John Couch Adams had predicted. Of course, it turned out that Challis had actually observed Neptune before Galle and D'Arrest but didn't realise he had done so. I wasn't a frequent user of the Northumberland, but I did learn observing skills on it. I am by no means the only BAA member to use the Northumberland; indeed, so many current section directors have used the 'scope that observing with it is almost a job requirement for the role. The last time I saw the Northumberland telescope in use was for the 2004 transit of Venus, when it was in service to project that momentous event.

So, I know about the Cambridge end of the story, and have done for many years, but the Neptune book puts the story in a wider context. Adams was a superb mathematician, but swamped by the demands of his career, and unable to give the post-Uranus planetary predictions the attention they required. Adams's predictions were scattered across a wide area of sky, the closest ones being given greater prominence post-discovery. Challis was doing his job, to survey a large area of sky repeatedly, and was not in a position to analyze his results, which, as it turns out, would have revealed Neptune. Le Verrier was also a great mathematician, but one who published and publicised his results. And Galle and D'Arrest deserve more credit than they usually get for actually looking. "That star is not on the map!" cried Galle, after barely two hours' search – and a new planet was discovered. I commend the book to you!

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I am saddened to have to tell you about the recent(ish) passing of two contributors to our section, one this year and one last.

The first, Peter Shimmon, featured in my previous "From the Director" notes in the spring edition of this newsletter. Peter and I corresponded on a variety of topics; almost uniquely, by paper rather than by email! It's fitting perhaps that in my last editorial I passed on to the section his suggestion that we should contribute memories of our introduction to astronomy; especially those of us who had the thrill to grow up in the space age. Peter Morris, I'm pleased to say, rose to Peter Shimmon's challenge, and presents his memories of the early space age later in this newsletter.

I continue to encourage the section to put pen to paper - or fingers to keyboard - and tell us about their life in astronomy. As I said to Peter Morris, your writings today might be primary source material for historians tomorrow.

As far as I know, I never met Peter Shimmon. By contrast, there weren't many astronomical events where I didn't bump into Eddie Carpenter. He was an enthusiastic attender of conferences, where he had the habit of asking the speakers to sign his copy of the program (I have the pleasure of introducing the speakers at the International Astronomy Show in the Midlands and grew used to Eddie sidling up to the latest speaker). Eddie himself was a great collector of astronomical antiquities and an entertaining speaker. In 2019, he gave the historical section a talk on glass lanterns, illustrated with working apparatus, which he had found in a junk shop.

The last time I heard Eddie lecture was to the SHA conference at Oxford in 2019, a joint meeting with the Société astronomique de France. Eddie wanted to tell us about Dorothea Klumpke, the American-born astronomer who became the first woman to head an astronomical department when she took charge of the Carte du Ciel project at the Paris Observatory in the 1890s. Dorothea was also a BAA Council member (as was her husband, Isaac Roberts) and was one of the subjects of my talk later in the conference on the "Pioneering Women of the BAA". So, Eddie was stealing my source material! But I didn't really mind, and I had plenty else to talk about.

Eddie passed away last year but I was reminded, reading a recent SHA posting, that I should celebrate his life. He was always entertaining, always enthusiastic, always smiling. And we'll miss him.

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An Antikythera Mechanism in LEGO® Parts!

Karl Herzog, Driftwood, Texas

A replica of the ancient Greeks' Antikythera Mechanism based substantially on standard LEGO® parts and of a design by Kurt Baty of Austin Texas has been constructed and evaluated as a functioning device for prediction of eclipses.

A Greek Original

The sea-salvaged remnants of the Ancients' brass Antikythera Mechanism have been studied extensively by scholars, including archaeologists, historians, mathematicians, engineers, epigraphists and tomographists, for over 100 years. The stunning conclusion is that the Greeks, in 205 B.C.E. or within some few decades thereafter, had crafted the remarkable device to predict the dates and times of occurrence or recurrence of solar and lunar eclipses in their future. In so doing, the Mechanism also predicted, as the world's first analog computer, the dates of lunar phases into the future: New Moon, Full Moon and the intervening lunar phases.

The Mechanism was a remarkable creation resulting from combination of Babylonian eclipse theory (*i.e.,* the Saros cycle); the Greeks own astronomical observations and theories; and a complex system of exquisitely crafted intermeshing gears with precise gear ratios to effect the mathematical description of the Earth-Moon-Sun dynamical system. The Ancients viewed the results much as we view an old-fashioned analog clock; that is, by observing the position of "hands" pointing to etched scales, *i.e.* dials, on the exterior faces of the Mechanism. The dials included those for the calendar date and the lunar month within the 18-year Saros cycle. Furthermore, the device directly displayed the relative positions of the Sun and the Moon, including its phases, as well as the five then-known planets. The Mechanism was driven forward (or backward) in time to a desired calendar date by a manually-operated hand crank. The ancient user then could view the predictions for the date.

Recreation in Plastic

Kurt Baty is not the first MOC Builder to replicate the major features of the Antikythera Mechanism using LEGO® parts, but his design is thought to be the most faithful to the original in terms of the design of the gearing. That closer adherence to the original dictated that some few of the gears be custom-created in plastic with 3D printing because of their unavailability as standard LEGO® parts.

While quite authentic to the original in terms of eclipse prediction and of predictions of the major lunar phases (conjunction and opposition), Baty's scope for his first LEGO® version excludes some features of the original Mechanism. Most notably, the recreation does not include visual display of the motions and positions of the planets known to the Ancients: Mercury, Venus, Mars, Jupiter and Saturn. Also, this particular version does not include the variable rate of the Moon's angular velocity with respect to its elliptical orbit around Earth. The latter exclusion does affect the accuracy of the display of the lunar phases between New Moon and Full Moon (or *vice versa*), but with no effect on

the dates of occurrence of New Moons nor of Full Moons, both of which must be accurate to enable judgement of the possibility of Solar and Lunar eclipses.
We note that other displays provided by the Antikythera Mechanism are excluded in the replication, as well: the Metonic and Callippic dials, the subsidiary Olympiad dial, and exposition of the Zodiac.

Construction

Baty's design requires about 1100 standard LEGO® parts plus five customized gears to supplement fifty (50) standard gears. Karl Herzog of Driftwood, Texas recently built one as test of Kurt's written instructions which are well-illustrated as is customary for LEGO® enthusiasts. Kurt was interested in how well a LEGO® novice would perform a construction in order to improve and finalize his assembly and calibration instructions. Karl "fit the bill" because his only previous experiences with this medium of construction had been in watching with amazement as his Grandsons rapidly assembled complex LEGO® designs.
Herzog has a long-term interest in the theory of eclipses and has presented to the Austin Astronomical Society on solar eclipses. [1] Karl has a particular interest in the Antikythera Mechanism having modeled, with software of high precision, the eclipses manifested on the Ancients' device. Also, he has created his own analog modeling of eclipse prediction *ala* the Greeks, not in plastic but rather as animations in PowerPoint. Karl's enthusiasm for the Mechanism and in having a tangible replica of same led him to become Kurt's "beta tester", as it were.
Herzog required some 25 hours to complete the assembly plus additional time on the phone with Baty to ask questions and offer comments. The results of the assembled mechanism have pleased both Kurt and Karl. The replica, one must remember, is made of plastic and, therefore, has some inherent minor "sloppiness" of action and may be prone to a requirement of periodic re-calibration, perhaps more frequently than the Greeks' metallic mechanism ever was. That disclaimer noted, the sight of the LEGO® version in operation on the kitchen table is an amazing testament to the ingenuity of the Greeks of 2200 years past.

Operation

In eager anticipation of results, Herzog had his newly-assembled mechanism calibrated to show the Full Moon and the associated total lunar eclipse of 2001 January 9. He then hand cranked the device forward steadily in time by over two decades, whilst ignoring many solar and lunar eclipses along the way, to the lunar month of 2024 April and the indicated New Moon of that month on April 8.
The Saros dials indicated that there would be a solar eclipse in that lunar month on April 8 at about 18:00 UT, or 1:00 pm in Central Texas. **This confirmed the date and timing of the next total eclipse to occur in the contiguous United States!**
Herzog then proceeded backward in time by just six months to 2023 October. A solar eclipse is indicated for this month, also. The New Moon of 2023 October 14 will afford Texans with a solar eclipse near mid-day as judged from the mechanism's Saros output. We know from modern eclipse theory that the solar eclipse on this day will be an

annular eclipse and not a total one. (Note that neither the original Antikythera Mechanism nor the LEGO® version can give indication of type of eclipse since the precession of lunar apsides is not tracked.)

Availability of Kits

Kurt is working to finalize his assembly and calibration instructions so that he can make the instructions and custom parts available to those interested in having their own "Antikythera Mechanism" or in gifting one to a precocious child or grandchild. It's about the size of two shoe boxes positioned upright on end and placed side-by-side, so it can be proudly displayed in a limited space. You may privately message Kurt Baty (MOC Builder: RTN_LNA) with questions.

https://rebrickable.com/mocs/MOC-82737/

https://www.shapeways.com/shops/rtn-lna

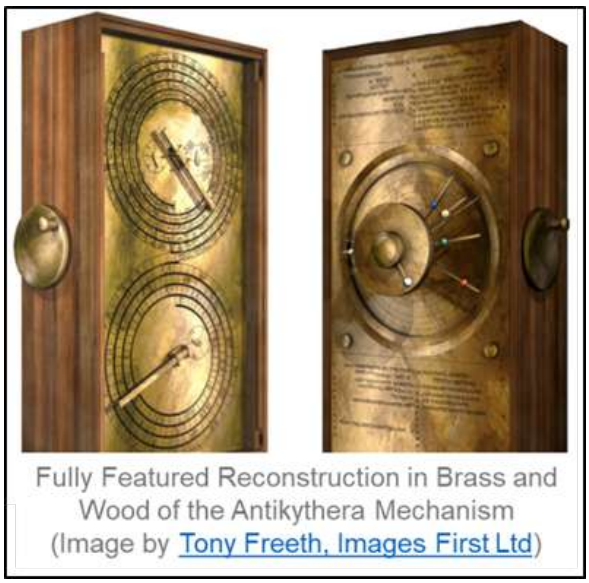
No kits are available, just instructions, parts list and links to the locations to purchase the parts. A free rebrickable account is necessary.

In the meantime, consider watching one of Kurt's YouTube presentations for more information on his LEGO® version. [2]

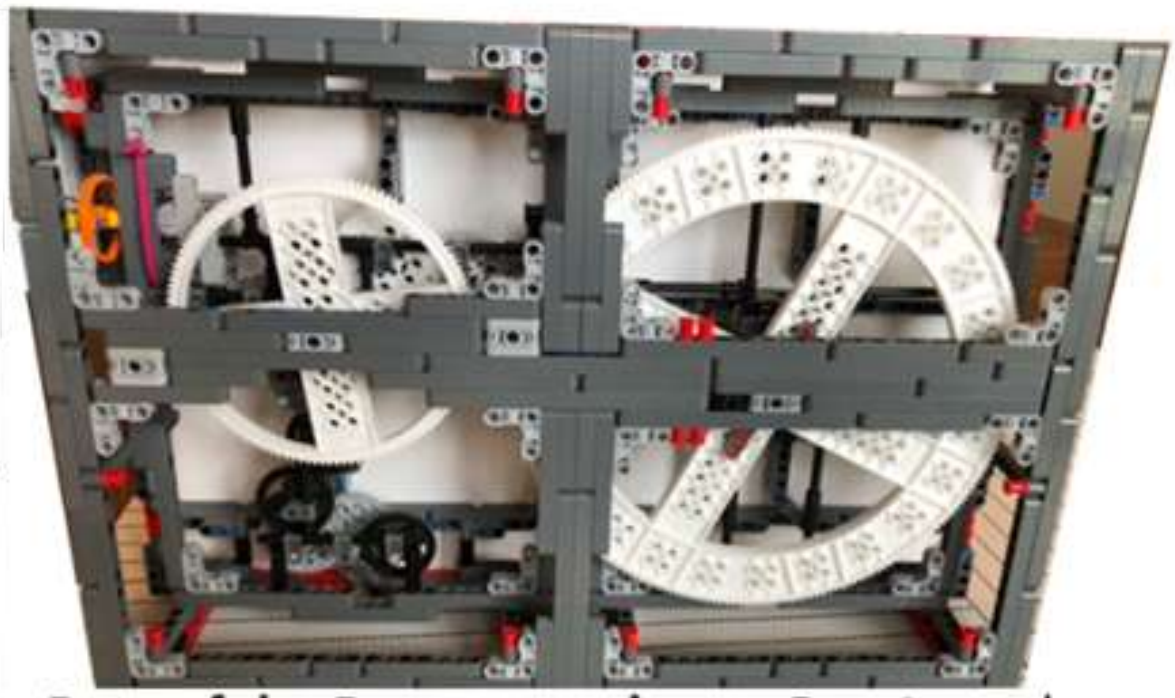
Videos on YouTube:

1. AAS GA Mar 2021 Karl Herzog Solar Eclipses - YouTube
2. LEGO Antikythera Mechanism (Ancient Greek Computer) - YouTube
   AAA GA Kurt Baty Antikythera Device September 9th 2020 - YouTube

A presentation on 'Predicting Solar Eclipses 2021-2070 with an "Antikythera Mechanism-Like" Model' can be downloaded from the historical section's download area: https://britastro.org/downloads/12386

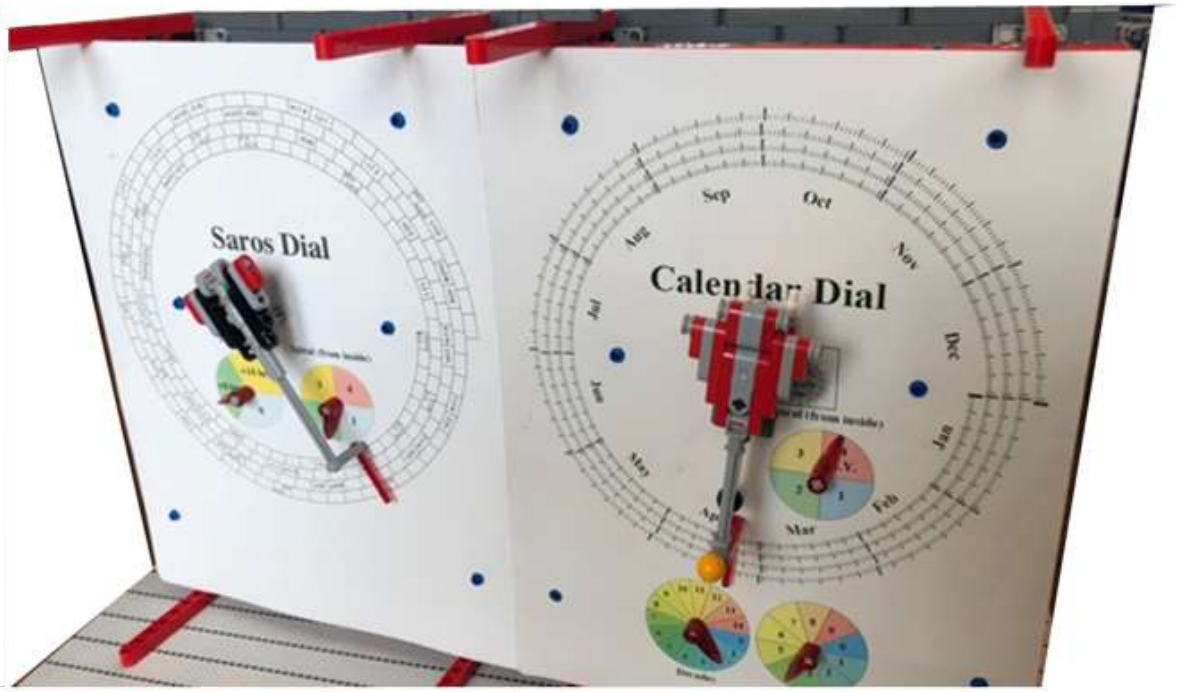


Fully Featured Reconstruction in Brass and Wood of the Antikythera Mechanism (Image by Tony Freeth, Images First Ltd)



Rear of the Reconstruction .... Dominated by two customized gears in white: the 127-tooth Calendar Gear (left) and the 223-tooth Saros Gear (right)

Sun and Moon Display .... Sun as orange sphere (lower left) with spherical Moon in black at conjunction indicating a New Moon on a date in April of a particular year (not shown here)



Prediction of Total Eclipse of April 8, 2024 .... **Calendar Dial** indicating date and displaying solar-lunar conjunction at New Moon (right). **Saros Dial** indicating the 60th lunar month as counted from the initial lunar month of Dec. 2000 – Jan. 2001 (left).

That 60th lunar month (shown at approx. 5:00 o'clock on the second spiral of the four-spiral Saros dial) had been marked during design as affording strong possibility of solar eclipse somewhere on Earth. A small gear-driven Time Adjustment dial indicates occurrence 8 hours after the 10:00 GMT base time of event.
This places the event at about 18:00 GMT or 1:00 pm local time in Central Texas.
Therefore, this will be an eclipse for the Americas !

Karl Herzog, completed his BS (1972) and MS (1973) with high honors in chemical engineering at Texas Tech where he was inducted into both the Tau Beta Pi (engineering); Kappa Mu Epsilon (mathematics) honor societies. He holds patents in polymer processing and natural gas liquefaction.
He says: "My interests in retirement include the modeling of eclipses, cosmogony of the solar system, history of astronomy from ancient times forward, and practical astronomy to teach my grandkids."
Karl says: "I spent several hundred hours a few years back programming the NREL methodology for solar and lunar positioning into an Excel spreadsheet. I checked it against all the solar eclipses visible In Athens from -600 to 100 CE as I studied the Antikythera Mechanism."

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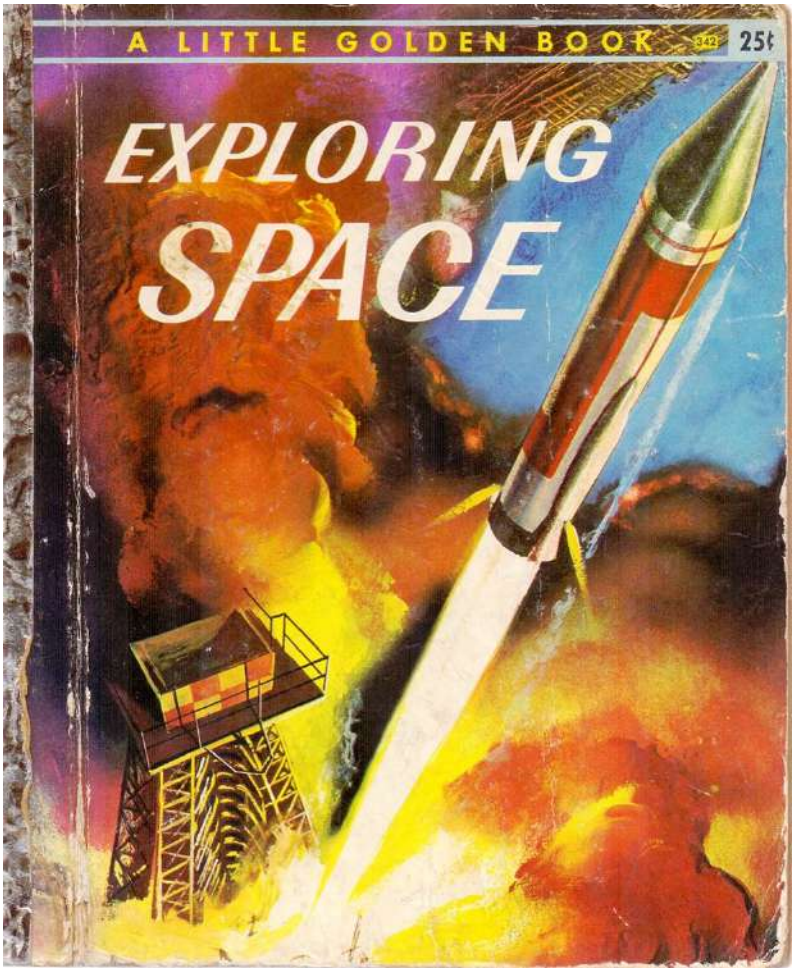
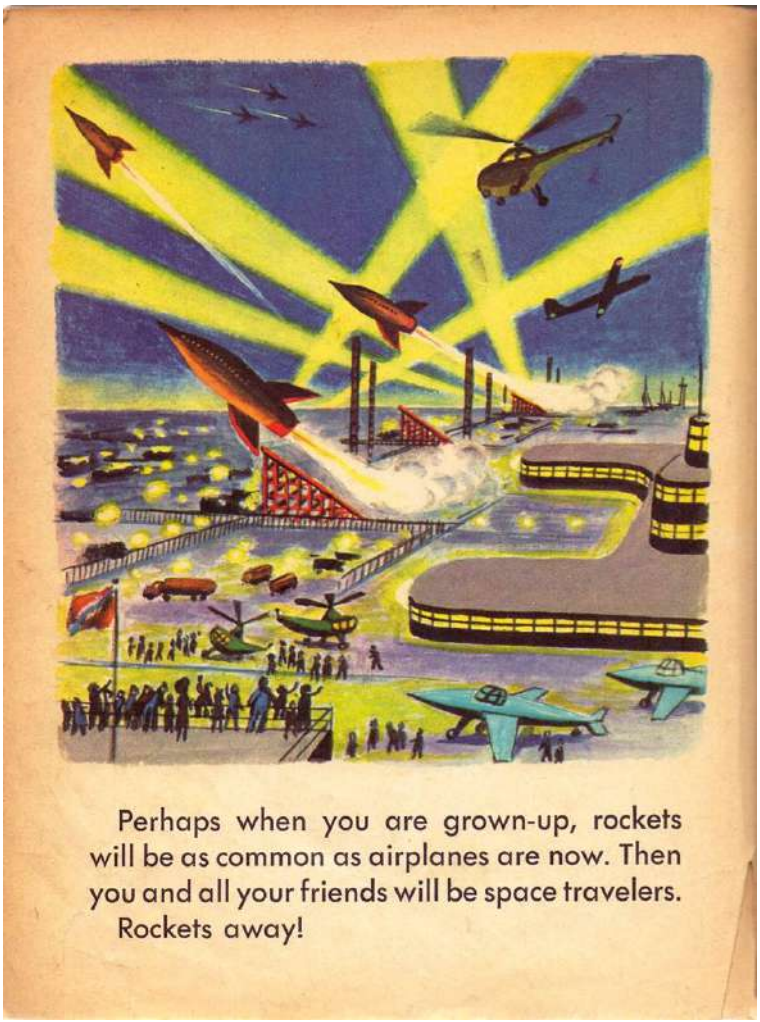
How I Became Interested in Astronomy

Peter Morris



Born in 1956, I was very much a child of the Space Age. One of my first astronomy-related books was *'Exploring Space'* by Rose Wyler in the American Little Golden Book series in about 1959 or 1960. The bit that made the most impression on me at the time was a concluding sentence: "Perhaps when you are grown-up, rockets will be as common as airplanes are now". I then read in about 1965 John Raymond, *'Men on the Moon'*, which was about Project Apollo before it even started. I must have read about astronomy, but the only early one I can find listed in my library catalogue of 1974 is the Ladybird book *'The Night Sky'* by Mary T. Brück, the Irish astronomer who was married to Hermann Brück. When I was eleven, I read Patrick Moore, *'The Observer's Book of Astronomy'*, but even at that age, I was a bit disappointed that it was only about naked-eye astronomy. Around the same age I read H. A. Rey, *'The Stars and a New Way to See Them'*, which helped me greatly in getting to know the constellations well. I should add at this point although I lived on the outskirts of London, one could still see the night sky clearly in the 1960s, making out even the fainter constellations and the Milky Way, the latter perhaps not very clearly but clearly enough. One big advantage when I was older was that most (if not all) the street lights went out at 1 am. People always closed their curtains and there were no security lights at all! Once I had a telescope, I started using Josef Klepesta and Antonin Rükl, *'Constellations'*, published by Paul Hamlyn in 1969 which was generally good although I found the colouring of the stars by distance rather than by their temperature was a bit strange.

My first astronomical instrument when I was about eight was a small drawtube refractor with a small tripod; I guess it was about 30mm in aperture. It was practically useless for anything other than the Moon. I then bought a pair of 10x50 “Admiral” binoculars from Boots; I wish now I had bought a pair of ex-Navy binoculars advertised in the newspaper by Charles Frank. Finally, after begging my parents for a telescope for Christmas for a couple of years, they bought me a 60mm Prinz telescope from Dixons at Christmas 1968. This was an excellent telescope even if its aperture was on the small side. I mainly observed double stars. Unfortunately, after several years’ use, the sidearm clamp became detached from the tube, rendering the telescope useless. The reader might be surprised that I never watched the “Sky at Night”, but I am afraid it was broadcast long after my bedtime! However, I did watch Patrick Moore, Cliff Michelmore and James Burke covering the Apollo missions. At at the time of the Apollo 11 mission, I had a map of the space between the Earth and the Moon, on which I moved a cardboard cut-out of the Apollo spacecraft several times a day. On the evening of 20th July 1969, I went outside and looked through my Prinz telescope for the lunar module on the Moon, but sadly could not see it! Eventually in 1974 I joined the Astronomical Society at Oxford University where I used a low-slung reflector (8 inch?) whereby you practically had to lie on the ground to look through the eyepiece. The highlight was seeing the asteroid Eros swing round Kappa Geminorum on 23 January 1975. I was a member of the Junior Astronomical Society (now the Society for Popular Astronomy) and from 1974 onwards, a student member of the Royal Astronomical Society although I did not proceed to full membership at that time.



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Astronomical Magazines and BAA Handbooks on Offer
Received from Colin Barnes

I don't know whether anyone at the Association would be interested in some old astronomical magazines!

I have BAA Handbooks from 1964 to 1973 Inc; Issues of Astronomy & Space from Vol.1 No.2 September 1971 to Vol.3 No.3 December 1973; Yearbooks of Astronomy from 1966 to 1974 + 1976 to 1978. I also have a few issues of New Scientist magazine dating from 29th July 1976 to 3rd March 1988 and Discovery Magazine from February 1965 to September 1966.

I also have issues of Planetarium from March 1968 through to June 1969 it then changed name to Astronomy Now and I have the issues September 1969 and December 1969. I also have four Science Journals: October 1966; October 1967; May 1969 and October 1969.

I am very reluctant to throw these away; I thought perhaps someone might be interested in possessing them, free of charge, of course.
If anyone is interested, they can be collected from my home in Littleport, just north of Ely.

Best regards

Colin Barnes (colin.barnes822@btinternet.com)

Dates for your diary

SHA Zoom Meeting, Wednesday, 2021 September 29, 19:30BST, 'Angelo Secchi, Jesuit and Scientist' by Ileana Chinnici (INAF-Palermo Astronomical Observatory). email: Meetings@shastro.org.uk to attend.

SHA AGM & Autumn Conference, Saturday, 2021 November 6, 11:00UT, email: Meetings@shastro.org.uk to attend

BAA Radio Astronomy Group Christmas Zoom Lecture, 'Jodrell Bank, the Cold War and the Space Race', Friday, 2021 December 10, 19:15UT, email: loginpaul@hearn.org.uk to attend.

Seen in reading
A Shining Furrow

A4 format, Pages: 182, ISBN: 9780954101312
This book has recently been published by Megavelda Press written by David Sellers is a comprehensive biography of BAA member Charles Thomas Whitmell (1849-1919) a U.K. amateur astronomer based in Leeds. The normal retail price is £27.00, but David has generously allowed a discount to £15.00 (plus £3.00 post and packing) for BAA Members. To obtain a copy email: magavelda@ntlworld.com