The Jeety Starn

No 3 Jun 2024 ISSN 3029-0848

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Welcome to Issue 3 of *The Jeety Starn*, the quarterly newsletter of the Stirling Astronomical Society (SAS). This issue includes articles on the fun of setting up a new telescope, the life and work of the great Islamic astronomer prince Ulugh Beg, the second in a series on the Astronomers Royal, hints on safe sunspot observing, our regular quotes with stellar overtones, and the second part of *The Sky in Scots*, which covers constellations 1 to 44.

Observing Sunspots Safely

By Alan Cayless

With solar activity approaching the peak of its 11-year cycle, this summer is an excellent opportunity to look for sunspots.

Safety is always important in solar observing. Sunlight carries a lot of energy, especially when focused in your eye or through an optical instrument, and for this reason you should never look directly at the Sun, either through a telescope or with the naked eye. However, with a little care sunspots can be observed safely and easily without any hazard.

Filters are not a good solution. Small filters that attach to the eyepiece are not safe and should never be used under any circumstances. Specialist filters that fit over the main objective lens of the telescope are available but are intended for use only by experienced solar observers. By far the easiest and safest method is by projecting the Sun's image onto a card. Some Newtonian telescopes are supplied with a screen that can be used for eyepiece projection, but if you don't have a dedicated attachment, you can simply hold a piece of white card approximately 18 inches from the eyepiece. A medium to low power eyepiece (e.g. 25 mm) will work best, giving a reasonably sized image. It is best to project the image sideways with the card edge on to the direct sunlight. With a refracting telescope, mounting the eyepiece in a diagonal will project the image to the side. If you have a Newtonian telescope the eyepiece is on the side anyway!

Remembering never to look through the eyepiece, the easiest way of lining up with the Sun is to look at the shadow of the telescope on the ground. Move the telescope to make the shadow smaller and once aligned with the Sun you should see a bright image projected onto the card. Adjust the focus knob on the eyepiece holder to focus the image and reveal the details.

Once projected onto a card the image can safely be viewed, and is also easy to photograph with a camera or mobile phone. It can be interesting to observe the Sun over a number of days – you will see the motion of the sunspots as they are carried across the Sun's disk by the rotation of the Sun, and also the development of groups of sunspots as they grow, coalesce and eventually diminish, to be replaced by new spots.

With a little care you can enjoy watching sunspots over the next few months until the darker nights return. Happy sunspot observing!

Ulugh Beg, Astronomer Prince

By Sandi Cayless

Astronomer and mathematician Mīrzā Muhammad bin Shāhrukh (1393/4 - 1449), popularly known as Ulugh Beg (*Great Ruler*), was the grandson of the great Turco-Mongol military leader Tamerlane. Married to a princess of the house of Genghis Khan, he succeeded at 16 years old to the governorship of Samarkand (1409) and in 1411 came to rule over what is now Uzbekistan, Tajikistan, Turkmenistan, Kyrgyzstan and southern Kazakhstan (the Mavarannahr khanate). He ruled from 1411 to 1449; he also occupied the Herat province in Afghanistan for a short period in 1448 after the death of his father. However, Ulugh Beg was also a poet and scientist, a patron of the arts and sciences who transformed the cities of Samarkand and Bukhara into cultural centres of learning, and the founder of one of the greatest schools of science. He is also recognised as one of the greatest of Islamic astronomers and mathematicians, particularly in the fields of trigonometry and spherical geometry.

Ulugh Beg built his great school, or madrasah (existing still in Rigestan Square in Samarkand, Uzbekistan), in 1417-20 for astronomical and other studies. In support of astronomy, he began building his observatory in Samarkand in 1424 (the Gurkhani Zij, which has been compared to the Uraniborg of Tycho Brahe), completing it in 1429 (detail on right). It was circular in shape, built on three levels, over 50 metres in diameter and 35 metres high. One of its most celebrated instruments was an 11 metre long sextant (the Fakhri sextant). Calibrated along its length and considered the world's largest 90 degree quadrant at the time, it had a radius said to be about 40 metres, with the radius of the meridian arc being about 50 metres and an optical separability of 180 arc seconds. Other important equipment included a triquetram, an armillary sphere and an astrolabe. Astronomers at the observatory in Samarkand could thus establish noon every day using the meridional height of the sun, distance from zenith and declination, they could work out the hour of the rising sun, predict eclipses and calculate the altitude of celestial bodies. Their deduction of 365 days, 6 hours, 10 minutes and 8 seconds for the stellar year was about 1 minute off modern calculations.

Ulugh Beg established the Earth's axial tilt at 23.52 degrees, a measurement that is not only more precise than those later made by Copernicus and

Tycho Brahe but that accurately matches the currently accepted value. He also catalogued 994 stars, publishing his Zīj-i Sultānī, an astronomical table and star catalogue, in 1437. The work itself was the joint effort of a group of Muslim astronomers at Samarkand including Beg, Jamshīd al-Kāshī and Ali Qushji.

It was judged the most accurate and extensive catalogue to that date, surpassing the works of Ptolemy (c. 90 – 168 CE), Abd al-Rahman al-Sufi's Book of Fixed Stars (964 CE), and the Maragheh observatory's (established 1259 CE) Zij-i Ilkhani, and only bettered in the 16th century by Taqi al-Din and Tycho Brahe. Beg re-determined the positions of 992 fixed stars known to Ptolemy, adding another 27 that were too far south for observation from Samarkand, from al-Sufi's Book of Fixed Stars. Ulugh Beg also produced trigonometric tables of sine and tangent values given at 1° intervals and correct to at least eight decimal places. Calculation was built on the accurate determination of sin 1°: Ulugh Beg showed it to be the solution of a cubic equation which he then solved numerically, obtaining sin 1° = 0.017452406437283571 (the correct approximation is sin 1° = 0.017452406437283512820).

Ulugh Beg was not however as skilled a commander and governor as he was a scientist and after various military successes, reverses and familial rebellions, as well as the death of his father in 1447, he was beheaded on the orders of his own eldest son (although his great-nephew later reinstated his reputation and placed his remains in Tamerlane's mausoleum in Samarkand). Ulugh Beg's observatory was destroyed by religious fanatics in 1449 and rediscovered in 1908; a small museum of astronomy, built in 1970 in his memory, now stands on its ruins. Copies of Ulugh Beg's Star Charts are kept in the museum; original drawings are housed in Oxford.

The remnant crater formation Ulugh Beigh (Ulugh Beg), located just west of Oceanus Procellarum and near the north-western limb of the Moon, was named for him by German astronomer Johann Heinrich von Mädler on his 1830 map of the Moon. Its coordinates are 32.7°N 81.9°W, it is 54 km in diameter and 1.7 km deep. The Main Belt asteroid 2439 Ulugbek, (1977 QX_2) discovered on 21 August 1977 by N. Chernykh at Nauchnyj (Crimean Astrophysical Observatory), was also named after him (details in table), as was the dinosaur Ulughbegsaurus, by Tanaka and colleagues in 2021. On a lighter note, a *Drake II* class starship of Mars Fleet in the book *Sub Martis: Starship* is named in honour of Ulugh Beg (Cayless 2018).

Ulugh Beg Collections

For a full list of Ulugh Beg's works in UK Libraries contributing to the Union Catalogue of Manuscripts from the Islamicate World (FIHIRST), see: https://www.fihrist.org.uk/catalog/person_66844656.

Asteroid 2439 Ulugbek	
Argument of Perihelion (°)	336.06635
Ascending Node (°)	115.44554
Orbital Inclination (°)	0.29210
Orbital Eccentricity	0.1484093
Perihelion Distance (AU)	2.6736443
ΔV w.r.t. Earth (km/sec)	10.2
Semi-Major Axis (AU)	3.1395886
Mean Anomaly (°)	67.71663
Mean Daily Motion (°/day)	0.17717190
Aphelion Distance (AU)	3.606
Period (years)	5.56
Absolute Magnitude	12.0
Phase Slope	0.15
Approx. Diameter (km)	21.5
	Data: IAU

References

Cayless, S (2018) Sub Martis: Starship. Sunskerry Press, Scotland. ISBN 9781999325909.

Knobel, EB (1917) Ulugh Beg's catalogue of stars: Revised from all Persian Manuscripts Existing in Great Britain, with a Vocabulary of Persian and Arabic Words (full text), Carnegie Institute, Washington, https://archive.org/details/cu31924012303800. Accessed 20 Mar 2024.

O'Connor, JJ, Robertson, EF (1999) Ulugh Beg. MacTutor History of Mathematics Archive, University of St Andrews. https://mathshistory.st-andrews.ac.uk/Biographies/Ulugh_Beg/. Accessed 20 Mar 2024.

Tanaka, K, Anvarov, O, Zelenitsky, D, Ahmedshaev, A, Kobayashi, Y (2021) A new carcharodontosaurian theropod dinosaur occupies apex predator niche in the early Late Cretaceous of Uzbekistan. *Royal Society Open Science 8 (9): Article ID 210923.*

The International Astronomical Union Minor Planet Center [Ref: Minor Planet Circ. 7784] (2439) Ulugbek = 1952 DT2 = 1955 UD = 1972 TC4 = 1974 CM1 = 1977 QX2 = 1979 BE = 1980 GN. https://minorplanetcenter.net/db_search/show_object?object_id=2439. Accessed 20 Mar 2024.

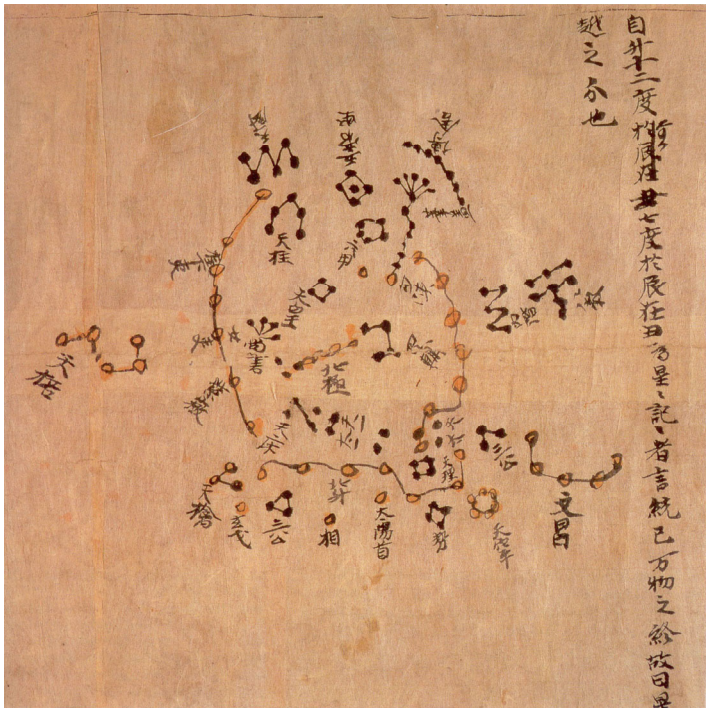
Verbunt, F, van Gent, RH (2012) The Star Catalogues of Ptolmaios and Ulugh Beg: machine readable versions and comparison with the modern HIPPARCOS catalogue. *Astronomy and Astrophysics 544 A31* DOI: 10.1051/0004-6361/201219596.

Waugh, DC (2002) Ulugh Beg and His Observatory. Silk Road Seattle Project, University of Washington. https://depts.washington.edu/silkroad/cities/uz/samarkand/obser.html. Accessed 20 Mar 2024.

The Dunhuang Star Map

The Dunhuang Star Map is the earliest known complete manuscript atlas of the night sky and was made in central China around 700 (Tang Dynasty, 618–907). It was found in Dunhuang (a Silk Road town) among 40,000 manuscripts in a Buddhist library cave in the 1900s. It depicts over 1,300 stars visible to the naked eye. The star symbols are divided into three colour groups: black (Gan De), red (Shi Shen) and white (Wu Xian), the colours representing the three Chinese Schools of Astronomical tradition. The yellow symbols represent others.

The stars are charted accurately using a projection system illustrating the curved sky on flat paper (invented by the Chinese before the 1st century BCE). The projection is similar to the one developed by Gerardus Mercator in the 16th century. The sky is divided into 12 segments. The chart shows the northern polar region, looking straight up.



Part detail of the Dunhuang Star Chart showing the North Polar region (British Library Or.8210/S.3326)

Poetic Licence

Another instalment of poetic and literary gems that could be read as having an astronomical bent.

Khayyam, Omar: Rubaiyat
Yon rising Moon that looks for us again –
How oft hereafter will she wax and wane;
How oft hereafter rising look for us
Through this same Garden – and for one in vain!

Malito, Giovanni: HAIKU
a shooting star
streaks the sky
making it real

clear night –
in the space of a smile
the meteor is gone

Milton, John: Il Penseroso
To behold the wandering Moon,
Riding near her highest noon,
Like one that has been led astray
Through the heav'n's wide pathless way.

Tolkien, J.R.R.: The Hobbit
The stars are far brighter
Than gems without measure,
The moon is far whiter
Than silver in treasure.

Service, Robert W.: The Ballad of the Northern Lights
And the skies of night were alive with light, with a throbbing, thrilling flame;
Amber and rose and violet, opal and gold it came.
It swept the sky like a giant scythe, it quivered back to a wedge;
Argently bright, it cleft the night with a wavy golden edge.

Updike, John: White Dwarf
Welcome, welcome little star!
I'm delighted that you are
Up in heaven's vast extent
No bigger than a continent.

Relatively minuscule
Spinning like a penny spoon
Glinting like a polished spoon
A kind of kindled demi-moon,

You offer cheer to tiny Man
'Mid galaxies Gargantuan –
A little pill in endless night
An antidote to cosmic fright.

Adventures with a Seestar S50

By John MacLean

Following discussion at an SAS meeting in January, about the Christmas present just received by one of the youngest attendees, I did a little further research and decided to award myself an early birthday present of the ZWO Seestar 50 at £539. As stated at the SAS meeting, there was indeed a waiting list at First Light Optics (FLO) for the next batch of deliveries, which I duly joined, and I also decided to order three 3-D printed accessories:

- Astro Essentials 3D Printed SeeStar S50 Dew Shield (£12)
- Astro Essentials SeeStar S50 Bahtinov Focus Mask (£9)
- Astro Essentials SeeStar S50 Push-Fit Lens Cap (£7)

plus a solid metal accessory:

- Astro Essentials Precision Tripod Level Adjuster (£29)

This made the all up cost for the package of £600.

Having joined the FLO waiting list in January, the kit arrived in early March, and on the first suitable dry evening was taken out to my heavily light polluted back garden right next to a busy road and a leisure centre, and switched on.

I had to download the Seestar app, and create an account, which posed no problems, remarkably for me! I then had to ensure that the Seestar was fully charged. Next I switched the Seestar on and was prompted to connect via the app, upon which a firmware update was downloaded to the telescope.

I initially decided not to connect the telescope to my home network, but will probably do this at a later date, as there is functionality in the Seestar app on my smartphone which will only work if connected to the internet, and when driving the telescope my smartphone has to be disconnected from my home network to enable it to connect to the telescope's local network.

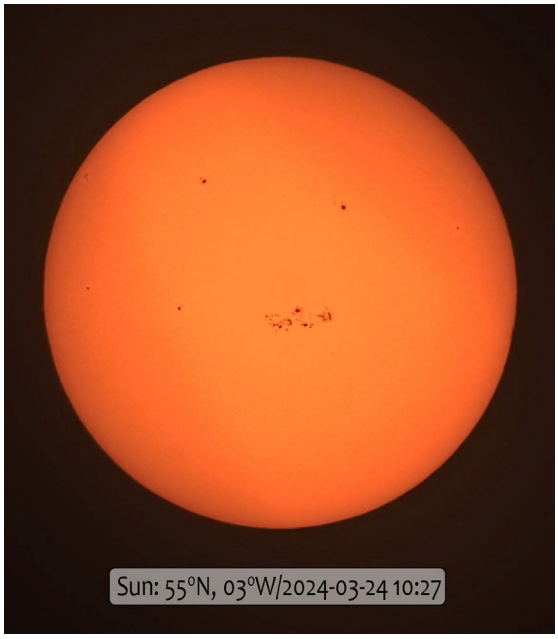
The only minor tricky process is to level the tripod, but the accessory I bought takes this irritation away completely. Everything else is either done for you automatically or you follow simple user prompted steps. As near idiot-proof as I can imagine.

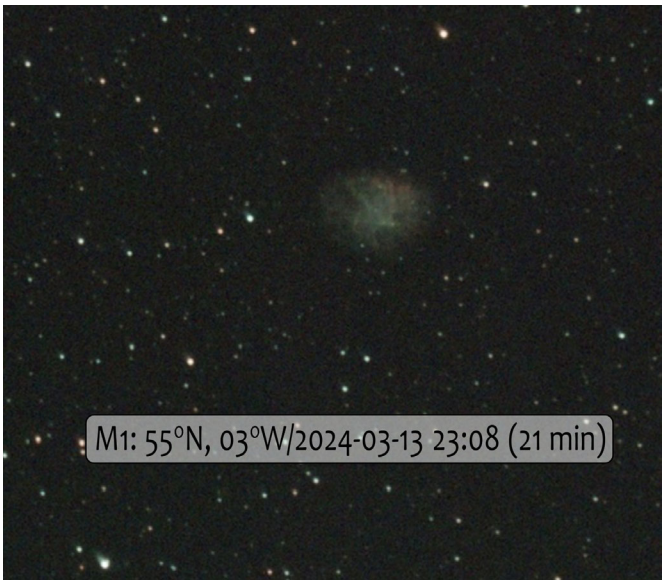
There are 5 basic modes of operation which you choose depending upon what you are about to observe i.e. Stargazing, Solar, Lunar, Planetary or Scenery, and the telescope sets itself up appropriately with internal filters and the like. The only outside help which is essential is of course to insert the (provided) solar filter when requested to do so by the telescope when entering the Solar mode.

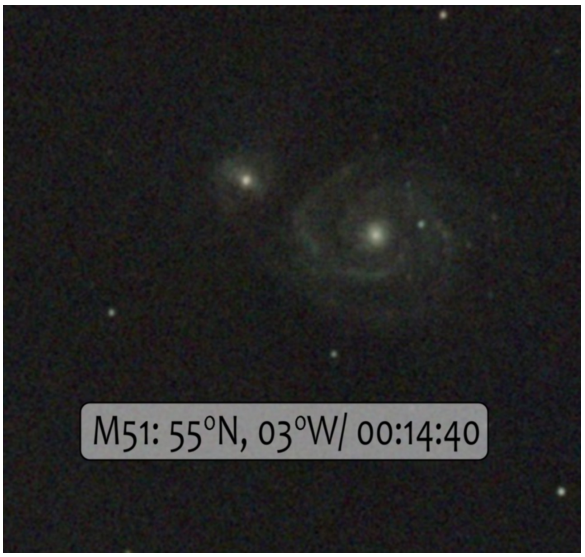
The telescope also suggests the best imaging opportunities at that time and location, and on choosing one, will automatically slew to its position. I didn't find I needed to manually adjust the centring, but I did play about with it anyway just to get a feel for how easy it is do. There are some optimisation options and other features which I haven't played with yet. You can also choose an object or area or position in a virtual version of the night sky and have the telescope slew to that, to provide the full control and any orientation you might want. Whilst in the kitchen I kept an eye on how the image was building up over time, using 10 second stacks (the stack time is user selectable), and stopped when I could see no discernible improvement of adding more stacks. The final image or video (plus all raw data if required) is held in the Seestar's memory, with the single images being copied via the app into the memory on the smartphone (or tablet, laptop or PC, depending on what you are using to drive it).

I have tried the telescope out on one evening and during one day (for the sun), and a couple of sample photos are attached, plus a photo of the telescope itself.

Once the telescope was connected to the app, planted in the garden and levelled, I retired to the warm kitchen to make a cup of tea whilst viewing progress on the stacking of signal and associated reduction in noise to get a remarkable final result, given the size and cost of the device. All in all, as far as astrophotography is concerned, this must be cheating, as it is too easy. However, to make the depths of the universe as widely available to the general population as possible, this setup is going to be hard to beat.



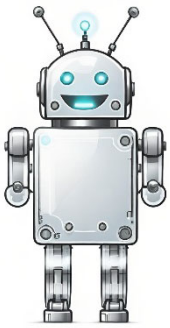




Images © J. MacLean

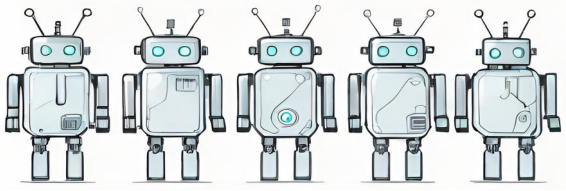
Robotic Utility

By Sandi Cayless



The robot talked of astronomy –
Words spinning into air
– truistic terminology
– perpetual pedantry
– nominal neologism.

The robot talked of astronomy –
Words staccato into ear
– incessant utterances
– banal badinage
– metallic machinations.



The robot talked of astronomy –
Words drumming into soul
– synonymic syllables
– literal illogic
– robotic ruminations.

The human hit the robot's off-button –
The robot subsided, speechless.

The human picked up a book and sighed…

The Sky in Scots 2 (1): Constellations 1 to 44

By Sandi Cayless

(Thanks to the Dictionaries of the Scots Language (*Dictionars o the Scots Leid*, www.dsl.ac.uk/) for terms/words, although I admit to some latitude (and much longitude) in borrowing these to provide descriptive terms… SC)

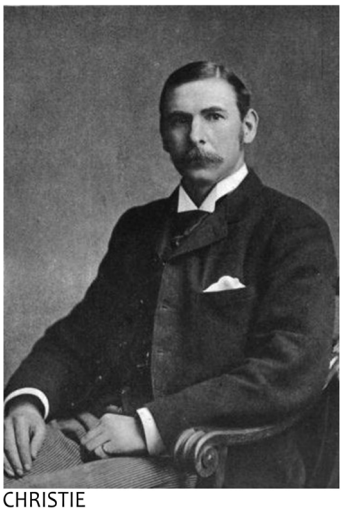
No	Constellation	English Name	Scots Name
1	Andromeda	Andromeda	Prenssis Andromeda
2	Antlia	Air Pump	Aire Pump
3	Apus	Bird of Paradise	Chookie-Burdie o' Heiven
4	Aquarius	Water Carrier	Watter Cairrier
5	Aquila	Eagle	Erne
6	Ara	Altar	Altair
7	Aries	Ram	Tuip
8	Auriga	Charioteer	Cairtair
9	Boötes	Herdsman	Hirdman
10	Caelum	Chisel	Clourer
11	Camelopardalis	Giraffe	Lang-Craigit Beastie
12	Cancer	Crab	Partan
13	Canes Venatici	Hunting Dogs	Ratches (Huntin' Dugs)
14	Canis Major	Big Dog	Muckle Dug
15	Canis Minor	Little Dog	Peerie Dug
16	Capricornus	Goat	Sea-Gait
17	Carina	Keel	Keel
18	Cassiopeia	Cassiopeia	Quene Cassiopeia
19	Centaurus	Centaur	Hauf-Cuddy Mannie
20	Cepheus	Cepheus	Keing Cepheus
21	Cetus	Whale	Whaal
22	Chamaeleon	Chameleon	Cheengefu' Beastie
23	Circinus	Compasses	Passers (Twa Pynts Fur Aw Airts)
24	Columba	Dove	Doo
25	Coma Berenices	Berenice's Hair	Berenice's Lang Herr
26	Corona Australis	Southern Crown	Soothern Croon
27	Corona Borealis	Northern Crown	Northren Croon
28	Corvus	Crow	Craw
29	Crater	Cup	Tass
30	Crux	Southern Cross	Soothern Cross
31	Cygnus	Swan	Swaan
32	Delphinus	Dolphin	Mere-Swine
33	Dorado	Goldfish	Gowden-Fishie
34	Draco	Dragon	Dragoun (Magik-Esk)
35	Equuleus	Little Horse	Peerie Cuddy
36	Eridanus	River	Lang Watter
37	Fornax	Furnace	Furnas (Closen Ingle)
38	Gemini	Twins	Twinnis (Twuns)
39	Grus	Crane	Cran
40	Hercules	Hercules	Michty Strang Mannie
41	Horologium	Clock	Knock
42	Hydra	Sea Serpent	Sea Sarpent
43	Hydrus	Water Serpent	Watter Sarpent
44	Indus	Indian	Indian

The Astronomers Royal (Part 2)

By Mark Butterworth FRS

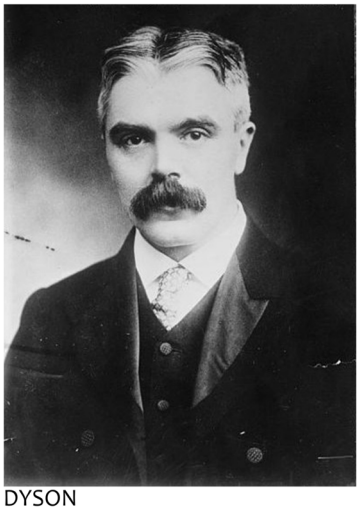
In Part 2 of a 4-part series by our late, much-missed member, Mark Butterworth FRS, reprinted from SAS Mercury newsletters 2005-2006 by kind permission of Mrs Pat Butterworth, Mark takes us from 1881 to the present in the story of the English Astronomers Royal. Illustrations are amended as appropriate; changes to original text are shown in square brackets.

Sir William Christie, 1811-1910


CHRISTIE

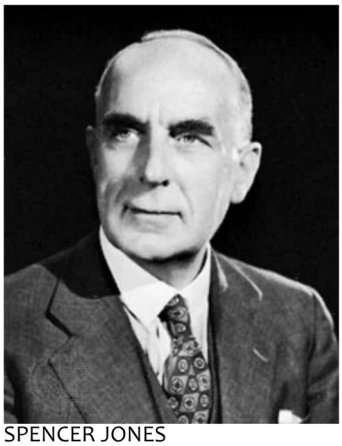
Christie was Chief Assistant at the Royal Greenwich Observatory (RGO) under Airy before appointment in 1881 as Astronomer Royal (AR). He began a programme of stellar photography and of making daily records of solar activity. He took part in the Astrographic Chart and Carte du Ciel projects for cataloguing and photographing the entire sky. Eighteen observatories were involved in this project from Italy, Finland, Germany, India, Belgium, France, Algeria, Spain, Mexico, Argentina, Australia, South Africa and the UK. Christie was also responsible for a number of additions to the RGO which included acquiring an 18 inch telescope.

Sir Frank Dyson, 1910-1933


DYSON

Dyson worked for the Royal Observatories (in Greenwich and Edinburgh) throughout his life. His work at Greenwich included managing the Carte du Ciel project, which in turn led him to investigate the proper motion of stars. He also studied the solar corona and stellar parallax. He went on eclipse expeditions including Sobral in Brazil (1919) – the same eclipse that was by Eddington off the west coast of Africa and used to confirm General Relativity. He was very interested in time, and was involved in setting up the 'six pips' signal first broadcast in 1924. After the First World War Dyson was involved in re-establishing international co-operation in science.

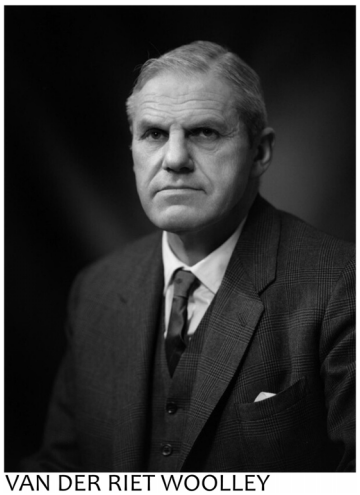
Sir Harold Spencer Jones, 1933-1955


SPENCER JONES

Under Spencer Jones the RGO worked with the Post Office to develop the speaking clock. He also installed a quartz crystal clock and moved the work, staff and equipment of the RGO to Herstmonceaux Castle in Sussex.

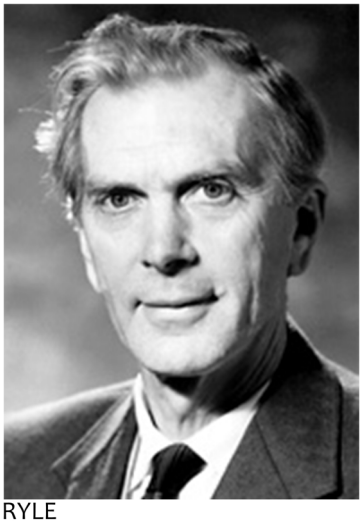
In 1928 Spencer Jones led an international project, initiated by the International Astronomical Union, to calculate the distance of the Sun from the Earth using photographs taken from 24 observatories of the minor planet Eros. In the 1930s he again worked on Eros and announced an improved value of solar parallax. He also worked on the colour and temperature of stars and on the Earth's rotation, and published an important paper in 1939 showing the Earth's rotation was not uniform.

Professor Sir Richard van der Riet Woolley, 1956-1971


VAN DER RIET WOOLLEY

Woolley was the last AR to also be Director of the RGO. He first joined the RGO in 1933 as Chief Assistant and worked on meridian astronomy, time service control, double star observation, solar spectroscopy and spectrohelioscope observations. In 1956 he became AR when the RGO was still moving equipment from Greenwich to Herstmonceaux. Besides transporting equipment, Woolley pushed for new equipment including the Isaac Newton Telescope. He also initiated summer courses at the RGO and built links with the University of Sussex.

Professor Sir Martin Ryle, 1972-1982


RYLE

After the Second World War Ryle worked at the Cavendish Laboratory in Cambridge, studying radio astronomy and designing an interferometer to study solar radio frequency emissions. This resulted in a radio map of the Sun in 1949 which was extended further in 1954 to produce the first radio map of the sky.

Appointed the first Professor of Radio Astronomy at Cambridge in 1959, he became AR in 1972, and in 1974 was awarded (with Professor Anthony Hewish) the Nobel Prize for 'pioneering the new science of radio-astrophysics'. Unlike ARs before him, Ryle's role at the RGO was principally consultative. Decisions about the research previously undertaken by the RGO were made by the holder of a new separated post, the Director.

Professor Sir Francis Graham-Smith, 1982-1990


GRAHAM-SMITH

Throughout the 1960s and 1970s Graham-Smith worked on radio astronomy at Manchester (Jodrell Bank), at the RGO and at Sussex University.

In 1976 he was made Director of RGO where he was involved in setting up the Northern Hemisphere Observatory on La Palma in the Canaries. In 1981 he moved back to Manchester to become Director of Jodrell Bank and in 1982 he became AR.

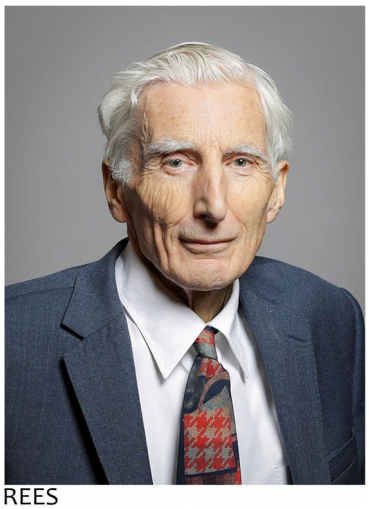
In 1990 the RGO moved site again, from Herstmonceaux to Cambridge, where it remained until its closure in October 1998.

Professor Sir Arnold Wolfendale, 1991-1995


WOLFENDALE

Wolfendale spent most of his career at Durham publishing on a range of topics including cosmic rays and their origin, gamma rays, solar and geomagnetic variation and cosmology. As AR he worked on promoting astronomy and campaigning for better funding for all the sciences. He [was appointed] Professor of Experimental Physics at the Royal Institute of Great Britain in 1995.

Professor Sir Martin Rees, 1995-Present


REES

Sir Martin Rees [Baron Rees of Ludlow], the current AR, is [Emeritus] Professor of Cosmology and Astrophysics and [was] Master of Trinity College at the University of Cambridge [2004-2012], and also Visiting Professor at Imperial College London and at Leicester University. In 1973 he became a fellow of King's College and Plumian Professor of Astronomy and Experimental Philosophy at Cambridge, and he served for ten years as director of Cambridge's Institute of Astronomy. From 1992 to 2004 he was a Royal Society Research Professor. He is a foreign associate of the National Academy of Sciences, the American Philosophical Society, and the American Academy of Arts and Sciences, and is an honorary member of the Russian Academy of Sciences, the Pontifical Academy, and several other foreign academies. He was president of the Royal Astronomical Society 1992-94. He was appointed to the House of Lords in 2005 and has been elected to serve as President of the Royal Society from November 2005 [in office 2005-2010].

His main current research areas are in high energy astrophysics, especially gamma ray bursts, galactic

nuclei, black hole formation and radiative processes, including gravitational waves. He is also interested in cosmic structure formation, especially the early generation of stars and galaxies that formed at high redshifts at the end of the cosmic 'dark age', and general cosmological issues.

He is the author or co-author of over 500 research papers, mainly on astrophysics and cosmology, and of numerous magazine and newspaper articles. His books include: *Gravity's Fatal Attraction: Black Holes in the Universe*; *Before the Beginning*; *Just Six Numbers*; *Our Cosmic Habitat*; *Our Final Century*; and *What We Still Don't Know*.

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A Quote or Two...

Barrow, John D. (1952-2020)

We are just strings of quarks living in a suburb of the local density maximum of the universe.

The universe is full of magical things patiently waiting for our wits to grow sharper.

There was no "before" the beginning of our universe, because once upon a time there was no time.

Bohr, Niels (1885-1962)

A physicist is just an atom's way of looking at itself.

Einstein, stop telling God what to do!

Bradbury, Ray (1920-2012)

We are the miracle of force and matter making itself over into imagination and will. Incredible. The Life Force experimenting with forms. You for one. Me for another. The Universe has shouted itself alive. We are one of the shouts.

Brahe, Tycho (1546-1601)

Now it is quite clear to me that there are no solid spheres in the heavens, and those that have been devised by the authors to save the appearances, exist only in the imagination.

When I had satisfied myself that no star of that kind had ever shone before, I was led into such perplexity by the unbelievability of the thing that I began to doubt the faith of my own eyes.

An astronomer must be cosmopolitan, because ignorant statesmen cannot be expected to value their services.

There is something eccentric in the orbit of Mars.

And when statesmen or others worry him [the scientist] too much, then he should leave with his possessions. With a firm and steadfast mind, one should hold under all conditions, that everywhere the earth is below and the sky above and to the energetic man, every region is his fatherland.

The mouse is wise, but the cat is wiser.

Interesting Asteroids (2)

By Sandi Cayless

The second part of an occasional series on asteroids of interest, the following deals with main belt asteroid 127005 Pratchett (2002 GY1) and the man who inspired the designation. Aptly named for Terence David John (Terry) Pratchett (1948-2015), the creator of *Discworld* and many other works, and also a keen amateur astronomer, asteroid 127005 was discovered by J. Dellinger and W. G. Dillon at Needville on 1st April 2002. Data on the asteroid can be found in the attached table.

Terry Pratchett's early interests included astronomy: he had a collection of cards about space and owned a telescope. He was also interested in radio, and he and his father belonged to an amateur radio club. Apparently, he wanted to be an astronomer whilst at school but felt that his knowledge of the essential mathematics was lacking. His writing skills were however well-recognised by one of his teachers, and a story he wrote when thirteen was repurposed as '*The Hades Business*' and published in the August 1963 issue of *Science Fantasy* magazine. With the proceeds of that he bought his first typewriter. He then wrote many more memorable stories, making an initial career in journalism. Terry was fascinated by natural history as well as astronomy (he was a trustee for the Orangutan Foundation) and in 1995, a fossil sea-turtle from the Eocene epoch of New Zealand was named for him (*Psephophorus terrypratchetti*) by palaeontologist Richard Köhler, as a nod to his creation, Discworld, a flat disc which sits upon the backs of four elephants who stand upon a giant turtle.

As his writing career progressed, Terry was awarded several honorary doctorates. The first was in July 1999, a Doctorate of Literature (D.Litt.) from the University of Warwick; he marked this honour by granting doctorates of the Unseen University to his co-authors of the recently-published '*The Science of Discworld*', Ian Stewart and Jack Cohen. Astronomy was still a strong interest, however, evidenced by the private observatory he had built in the back garden of his Wiltshire home. He appeared as part of BBC Four's broadcasts in celebration of 48 years of *The Sky At Night* on 6th August 2005, in a part about the contribution of amateur astronomers. He showed viewers around the observatory in his back garden and said his interest in astronomy had begun as a young boy, which led him into science fiction.

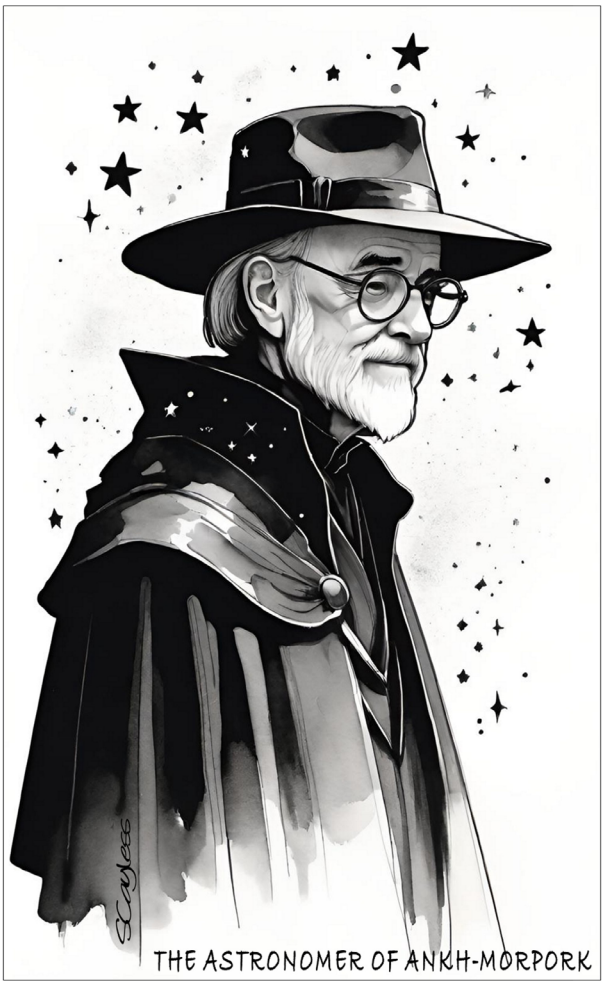
He also made an appearance on *The Sky at Night*, with other guests, at Sir Patrick Moore's 88th birthday party on 4th April (BBC 1) and 9th April (BBC 2) 2011. When asked his favourite constellation, he chose Orion.

Asteroid 127005 Pratchett	
Argument of Perihelion (°)	143.42310
Ascending Node (°)	128.26664
Orbital Inclination (°)	7.27861
Orbital Eccentricity	0.2044653
Perihelion Distance (AU)	1.8761302
ΔV w.r.t. Earth (km/sec)	8.8
Semi-Major Axis (AU)	2.3583259
Mean Anomaly (°)	257.69043
Mean Daily Motion (°/day)	0.27214370
Aphelion Distance (AU)	2.841
Period (years)	3.62
Absolute Magnitude	16.5
Phase Slope	0.15
Approx. Diameter (km)	1.2
	Data: IAU

Terry was knighted by the Queen at Buckingham Palace on 18 February 2009, and later in 2009, in celebration of that event, he forged his own sword (as obviously a knight needs one). Terry, with help from friends, dug out the iron ore from a field about 10 miles away and hauled 80 kilos of it home. He used clay from his garden and straw to make a kiln, and lit the kiln with wildfire made with a bow. His friend and agent Colin Smythe donated a small piece of meteoric 'thunderbolt iron' (from the Sikhote Alin meteorite) and a local blacksmith helped him forge his sword. According to his daughter Rhianna, he named his sword the *Thunderbolt Iron*. In 2009 Terry was appointed an adjunct Professor at Trinity College, Dublin University. In 2010 he was granted a coat of arms by Her Majesty's College of Arms. The crest is described as 'Upon a Helm with a Wreath Argent and Sable On Water Barry wavy Sable Argent and Sable an Owl affronty wings displayed and inverted Or supporting thereby two closed Books erect Gules'. The escutcheon is described as 'Sable an ankh between four Roundels in saltire each issuing Argent'. The motto he chose was 'Noli timere messorem (Don't fear the Reaper)'.

Terry wrote 59 books during his life, and co-authored 30. Numerous stage adaptations, readings, translations and television series have been made of his work, two musicals, four graphic novels, and four

TV documentaries, an amazing achievement. Terry passed away in March 2015 after a lengthy battle with a rare form of Alzheimer's disease.



Asteroid 127005 Pratchett was observable from Stirling earlier this year, in the constellation of Virgo. The latest time to view was mid-May, when it became visible at around 00:16 (GMT+01:00), 35° above the southern horizon, becoming lost in the dawn twilight at around 02:10, 26° above the south-western horizon (absolute magnitude 16.51). Alas, from mid-May onwards, 127005 Pratchett is not observable from Stirling, as the summer sky is too bright for it to be visible.

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A Song Called Astronomy...

There have been quite a few songs with ***Astronomy*** as or in the title; here are some examples:

Astronomy – first published on the 1974 album *Secret Treaties* by Blue Oyster Cult; it was also covered on the 1998 album *Garage Inc* by Metallica.
Astronomy – a song on the 2006 album *Astronomy* by Dragonland; the album also includes the songs *Supernova*, *Cassiopeia*, *Contact* and *Antimatter*.
Astronomy – a song on the 2003 fifth full-length album *Astronomy* by the Christian rock band Bleach.
Astronomy – by Jethro Tull, on the 15th studio album produced by the band in 1984.
Astronomy – by Good Luck Varsity on their September 2007 debut EP *Head High Heavy Hearted*.
Astronomy – by Thin White Rope on their album *In The Spanish Cave* (1998) and also on their album *The One That Got Away* (1993 and 2002).
Astronomy (8th Light) – on *Black Star*, an album-length collaboration of Talib Kweli and Mos Def released in August 1998.
Astronomy Domine – by Pink Floyd. It was written and composed by Syd Barrett and the first track featured on their debut album *The Piper at the Gates of Dawn*, in 1967. It has been covered by several artists since then.
Astronomy Is My Life, But I Love You – on the 2006 EP *Astronomy Is My Life, But I Love You* by Breaking Laces.
Divine Astronomy – by Human Fortress on their album *Lord Of Earth And Heavens Heir* in 2001.

Happy Observing!

There's plenty to see in the sky from June onwards. In the northern hemisphere we can look forward to noctilucent cloud season (*noctilucent*: Latin, *night shining*). These glowing, silver-blue clouds peak in June and July and appear after sunset and into early morning. They often resemble thin and streaky cirrus (see right), but other shapes can be seen. Noctilucent clouds are formed in the mesosphere by ice crystals growing around dust particles suspended in the upper atmosphere. If you look west after sunset and towards the northeast before sunrise, you may have a chance of spotting them.

The waning crescent Moon is close to Mars on 3rd of June, whilst in early morning on the 4th, you might spot Jupiter and Mercury half a degree apart. The solstice on 20 June heralds summer for the northern hemisphere; the full moon of June 22 was known as the Strawberry Moon to early Native American tribes as it marked the time of year to gather ripening fruit. The next full moon of 21 July has been known as the Buck Moon (when male buck deer begin to grow new antlers), the Thunder Moon and the Hay Moon. July 22 brings Mercury to greatest eastern elongation and is a good time to view.

The Perseid meteor shower (from the debris stream of comet Swift-Tuttle, aka the Great Comet of 1862) will be visible 17 July to 24 August, with its peak at 12-13 August (first quarter Moon, so good viewing!). The Perseids are an intense shower of bright meteors and (sometimes) fireballs and at the peak there may be up to 100 visible per hour. The meteors seem to emanate from Perseus, and their radiant is always above the horizon in the UK. The best viewing time will be just before midnight to 05:30 a.m. on the 12-13 August in 2024. Ambling alongside for much of the time (July 18 to August 21), the less intense Delta Aquariids (comet 96P/Machholz) peak in late July, but this year the waning gibbous and last quarter moon will light up the sky past midnight to foil viewing.

August 19 brings us a Blue Moon (usually, three full moons occur in each season of the year, but as full moons occur every 29.53 days, now and then a season will have an extra full moon – the blue moon. Blue moons occur about once every 2.7 years. This particular full moon is also known as the Sturgeon Moon (sturgeon are more easily caught at this time of year), the Green Corn Moon and the Grain Moon.

S.C.

The Jeety Starn

The Jeety Starn
ISSN 3029-0848

No. 3, June 2024
Publisher: Stirling Astronomical Society, Stirling
Editor: Dr Sandi Cayless
Designer: Dr Sandi Cayless

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