Transit

Autumn 2015

Lunar Eclipse
by Keith Johnson
Skywatcher EQ6 Pro. mount.
Meade 6.3 focal reducer.
Celestron C9.25" OTA
Canon 600D

Contents

Editorial

Welcome to the autumn edition of Transit.

Unfortunately we have had to take the decision to reduce this publication from monthly to quarterly. This is mainly due to the difficulty in obtaining material that we can publish.

I would like to thank all those who contribute to transit, and as usual make a request to anyone out there who may wish to send something in. It doesn't have to be a full article, it can just be a letter or photo.

Our cover picture (and the one below) are from this months lunar eclipse, one of the best I have seen (right up to the point where the fog rolled in that is). We had a number of people send us in photo's, a small sample of which are included on the Members Photo's page (Thanks to everyone who sent in pictures, and apologies to those who's pictures we didn't publish)

Regards
Jon Mathieson (Editor)

Transit Magazine

Autumn 2015

Published on behalf of
Cleveland and Darlington Astronomical Society

For editorial and content submission please contact:
Jon Mathieson
12 Rushmere
Marton
Middlesbrough
TS8 9XL
Email: **transit-editor@cadas-astro.org.uk**

For enquiries about the society
Please contact the general-secretary:
Email: **general-secretary@cadas-astro.org.uk**

Society website:
www.cadas-astro.org.uk

Telescope Making Seminar

John Nichol is holding a telescope making seminar in Billingham on Sunday 22nd November from 10am till 4pm.

The event will cover all aspects of telescope making, including the grinding and polishing of mirrors.

Attendance costs £30.00 and anyone interested should contact John_nichol@hotmail.com

Further details can be found at www.nicholoptical.co.uk/seminar2015.htm

Lunar Eclipse from start to Totality

by Keith Johnson

Skywatcher EQ6 Pro. mount.
Meade 6.3 focal reducer.
Celestron C9.25" OTA
Canon 600D

Hubble's ultraviolet telescope has revealed more about the stars than we could ever see

By Carole Haswell (Originally published online on The Conversation.com)

The Galaxies NGC4038 & NGC4039, locked in a destructive embrace (Hubblesite.org)

It's probably fair to say that the Hubble Space Telescope, which recently celebrated its 25th birthday, has become the world's most famous telescope in large part due to the breathtaking astronomical images it has captured.

Hubble's images reveal the complex, three-dimensional structure of galaxies, nebulae and star-forming regions with incredible acuity, chiefly because the telescope is in space. For ground-based telescopes, the Earth's atmosphere has a blurring effect, limiting the sharpness of the images they produce. Hubble's images are limited only by the telescope's engineering and the properties of light itself.

In 1990 I was privileged to be present at the space shuttle launch which carried Hubble into orbit. The combination of the launch's powerful demonstration of the defiance of gravity, coupled with the promise of what Hubble would do for astronomy was overwhelming. Curmudgeonly male scientists wept.

Perhaps the affection directed towards Hubble is also partly due to the telescope's troubled start: the primary mirror was very precisely manufactured, but to the wrong shape. For the first three years of operation, Hubble's ability to produce sharp images was compromised, to the point that "Hubble Telescope" was a joke appearing in cartoons and punch-lines.

So engineers produced COSTAR, a component that would correct the optical problems with the primary mirror. Installed during the first space shuttle visit to Hubble, it worked a treat. Like a flawed hero or a prodigal child, Hubble's triumph over adversity has universal appeal – the best stories, like the best images, have contrasts between darkness and light.

Astronauts Hoffman and Musgrave working on the HST in 1993 (NASA)

More than just light

Fortunately, not all of Hubble's science had to wait three years for the first servicing mission. Scientific astronomy is carried out in other regions of the electromagnetic spectrum than just visible light, for example ultraviolet (UV) light. UV is invisible to our eyes, but forms the continuation of the visible spectrum beyond the violet.

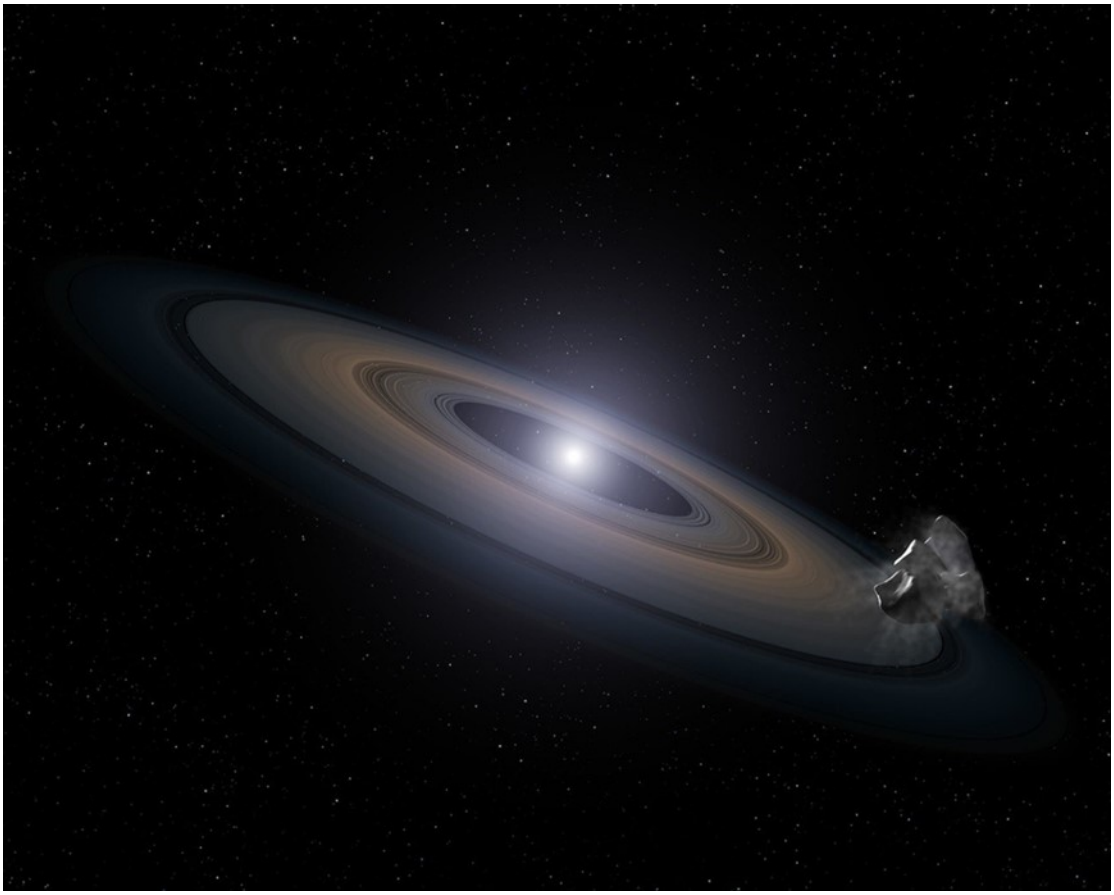
Hubble had always been intended to serve as an ultraviolet telescope – from space, UV light that would otherwise be absorbed by Earth's atmosphere can be collected. Light in this part of the spectrum is more energetic than visible light and is emitted by most stars, including our own, and many other astrophysical objects. Studies in ultraviolet radiation reveal things that can't be learnt from telescopes on the ground.

A 'hot Jupiter' exoplanets atmosphere is stripped away by the heat of its star (ESA/Alfred Vidal-Madiar/NASA)

Hubble has produced many, many UV science results. My favourite is the spectacular discovery in 2003 that the exoplanet HD209458b is surrounded by a huge cloud of hydrogen gas. This type of exoplanet, known as a "hot Jupiter", orbits its star so closely – only a 20th of the Earth's distance from the sun – that the star's heat boils off the planet's atmosphere.

Insight into the future

This sort of discovery offers a great opportunity to learn what exoplanets are made of. Spectroscopy is the key: each chemical substance has its own spectroscopic fingerprint that allows astronomers to measure chemical compositions – and the UV region of the spectrum is particularly sensitive and useful for this purpose. Hubble has used these strong UV features to reveal the presence of hydrogen, magnesium, iron, silicon and other chemicals in the atmospheres of several hot Jupiter-style exoplanets

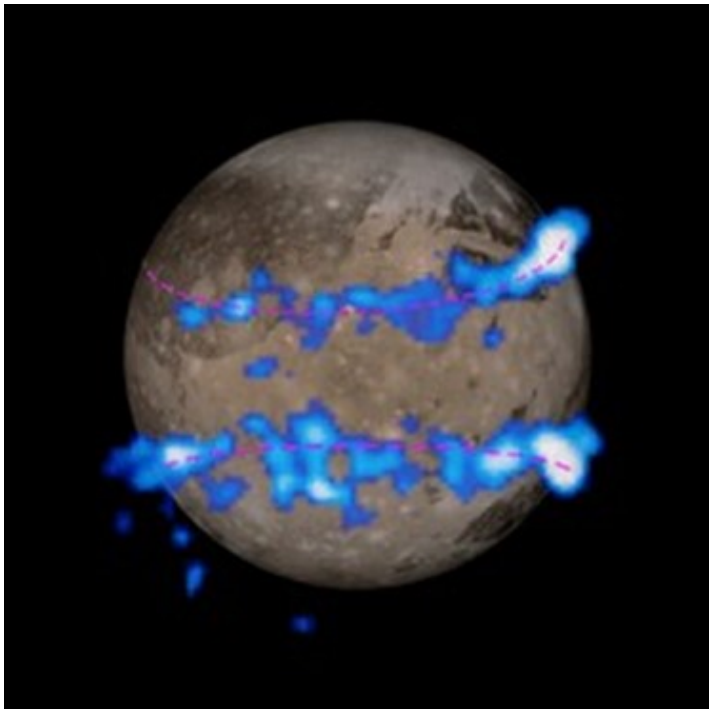


Our ultimate fate: a white dwarf star collapsed from a giant red, surrounded by remnants of the inner planets (ESA/G Bacon/NASA)

The loss of the atmosphere of these exoplanets is a preview of the ultimate fate of the Earth, when the sun becomes a red giant star in about four billion years time. As the sun begins to exhaust hydrogen at its core and begins to burn helium, it will swell and become hotter and brighter, engulfing Earth and the inner planets. Once it has exhausted its nuclear fuel, it will collapse into a white dwarf star – about the size of the Earth, and surrounded by the remnants of our solar system.

Hubble UV spectroscopy of white dwarf stars has revealed that many of them are being continually bombarded by asteroids feeding the stars with rocky material. These observations allow us to learn the types of rocks present in extinct planetary systems which were perhaps once very similar to our own solar system.

Most recently and closer to home, UV images reveal the aurorae around Ganymede, Jupiter's largest moon. Just as with Earth's aurora borealis and australis (northern and southern lights), Ganymede's aurorae change continuously with the influence of Jupiter's magnetic field. Hubble captured changes in the aurorae caused by the presence of an underground salt-water ocean on Ganymede – an ocean that probably has more water than all of Earth's oceans combined and may provide a habitat for life.



Appearance in UV of aurorae on Ganymede (NASA/ESA)

Hubble has continued its mission well beyond its original planned lifetime. It has made over a million observations and generates about ten terabytes of new data each year. The current plan is for it to operate beyond 2020, to allow some overlap with its replacement, the NASA/ESA/Canadian Space Agency joint project, the James Webb Space Telescope (JWST).

Sadly for UV astronomy, the JWST will work predominantly in infrared and has no UV instruments. This leaves many astronomers keen to see a successor to Hubble that will continue its unique work in UV, which has added so much to human understanding by working beyond what we can see.

Book Review

By Neil Haggath

I've recently read an excellent new book, which I would thoroughly recommend to anyone with an interest in the history of astronomy. It's entitled Stargazers: Copernicus, Galileo, the Telescope and the Church (Lion Books, 2014, £10.99) and if I tell you that its author is Dr. Allan Chapman, then need I say more?

Allan needs no introduction for many of us. For those who don't know him, he's a historian at Oxford University, who specialises in the history of science; he's certainly the UK's, and quite possibly the world's leading authority on the history of astronomy. He's also undoubtedly the best and most in-demand speaker on the astronomical societie's circuit. I also have the honour of having counted him a personal friend for over 20 years.

Allan is equally accomplished as a writer. In his books, as in his talks, he frequently dispels the popular myths and misconceptions of what he calls "the Enid Blyton school of the history of astronomy". In this case, the common myth that the Catholic Church, in the time of Copernicus and Galileo, imprisoned or executed anyone who dared to challenge the ancient religious dogma that the Earth was the centre of the Universe. It's often said that Copernicus didn't dare publish his book De Revolutionibus until he was on his deathbed, for fear of reprisals – not true at all, as copies were in circulation several years before his death. It's also often said that Giordano Bruno was executed for heresy for teaching Copernicanism – again, not true. While he was executed for heresy, teaching Copernicanism was just one of many heresie's of which he was guilty in the Church's eyes, and a trivial "crime" in comparison to his many more.

While it's certainly true that Galileo was tried by the Church, and forced to make a meaningless denial of Copernicanism, Allan says he isn't aware of any other astronomer being tried for the same "offence". (In fact, nowhere does the Bible actually say that the Earth is the centre of the Universe!) Galileo's "crime" was not so much what he taught, but the way he went about it; he wasn't known for his tact, and basically got up the noses of a lot of influential people. In his famous book, Siderius Nuncius, he portrayed the Pope as a simpleton – not a wise move in those days, even if it happened to be true!

While there were undoubtedly some clergy who demanded that belief in a heliocentric Universe should be punishable by fire and brimstone, they were in the minority, at least among the higher echelons. The attitude of most church leaders was not one of "This is heresy, and anyone who believes it will go to Hell!", but rather, "OK, if you want us to accept this idea, show us proof!" Doing the latter wasn't so easy; in fact, it was a further century before astronomers found indisputable physical proof that the Earth moves, in the form of James Bradley's discovery of the aberration of light.

Allan tells us all this, and much more, in his own inimitable and very readable style.

I have only one minor quibble with the book. As Allan is himself a devout Christian, his position is not entirely impartial, and there are a couple of instances where he defends the Church a little too strongly for my liking. But this doesn't detract from the overall excellence of his narrative. It's a highly enjoyable and informative read.

The Celestial Pathway of Pluto

by Michael Roe

This is the big year for Pluto, the 9th planet.

In the summer of 2015 we at last got to see close up images of this mysterious world from the New Horizons space-craft, a great achievement, but in this article I want to concentrate on the celestial pathway of Pluto.

It was first discovered by Clyde Tombaugh on 18th February 1930, photographically from two glass plates taken on January 23rd and 29th, with a 13 inch telescope on a deliberate search.

Clyde Tombaugh

Its discovery position was about +22 degrees north Right Ascension 7 Hours 20 minutes, near to the star Delta Gemini which shows up on the earliest photographs. In fact on the 7th May 1930 Pluto almost occulted this star. Also by coincidence Pluto crossed the ecliptic at this time, going North.

Pluto's orbit was soon calculated to be unusual, its path is included by 17.2 degrees to the ecliptic, whereas most planets hug the line of the ecliptic, the path our Earth goes round the Sun. Also the orbit of Pluto has an eccentricity of 0.247, from 2,760 million miles to 4,580 million miles from the sun, averaging 3.672 million miles. It is a very small planet, just 1,450 miles in diameter with one large satellite 'Charon'.

Before its discovery Pluto reached Aphelion in 1865, at a faint magnitude of +16 beyond the visibility of pre-photographic victorian astronomers.

By 1890 it passed near Aldebaran, then arounf 1900 near the Crab Nebula. Just before discovery, in around 1927, it passed close to Zeta Gemini, then as previously mentioned, passed close to Delta Gemini to cross north of the ecliptic. Pluto was now at its average distance, and at magnitude +15 still visible with large telescopes only.

From 1930 to the present, Pluto has covered only part of its long 248 year orbit. That year the constellation boundaries were put in place by the International Astronomical Union, who sadly insulted Pluto's planetary status 76

years later.

Back to Pluto's pathway. In 1945 the planet passed a few degrees north of the M44 star cluster, around 1938 it crossed into the constellation of Cancer 'the crab'. Arounf 1948 Pluto reached its highest declination north about 24 degrees, a little more than the ecliptic but 3 hours further around the celestial sphere.

In 1949 Pluto entered Leo the Lion getting further from the ecliptic, being a large constellation, Leo kept Pluto until 1968, around 20 years. Then Pluto entered Coma Berenices, a constellation outside of the zodiac, named as Queen Bernices hair.

NGC 5248

Around 1972, Pluto skimmed the northern edge of the Virgo Galaxy Cluster, near the M88 Galaxy, but nearer still M100. In 1974, Pluto passed south to Virgo, the celestial virgin, going over Epsilon Virgo in 1976. Then in 1979, Pluto paid a short visit to Bootes, the constellation of the herdsman, another non-zodiacal constellation, passing very near the faint galaxy NGC5248.

In 1980 Pluto returned to Virgo. The years from 1970 to 1990 would have been the best years to observe Pluto from Britain, as it was almost at its brightest magnitude +14 and fairly high up in our skies. I expect only afew dedicated observers have ever observed Pluto visually from our country (Using large telescopes of at least 10 inches aperture). Afterwards, Pluto became far more difficult, moving lower into murky low skies and hampered by the summer brightness. I wonder who was the first observer from Britain to see Pluto, and who was the last. One was certainly Patrick Moore in 1982.

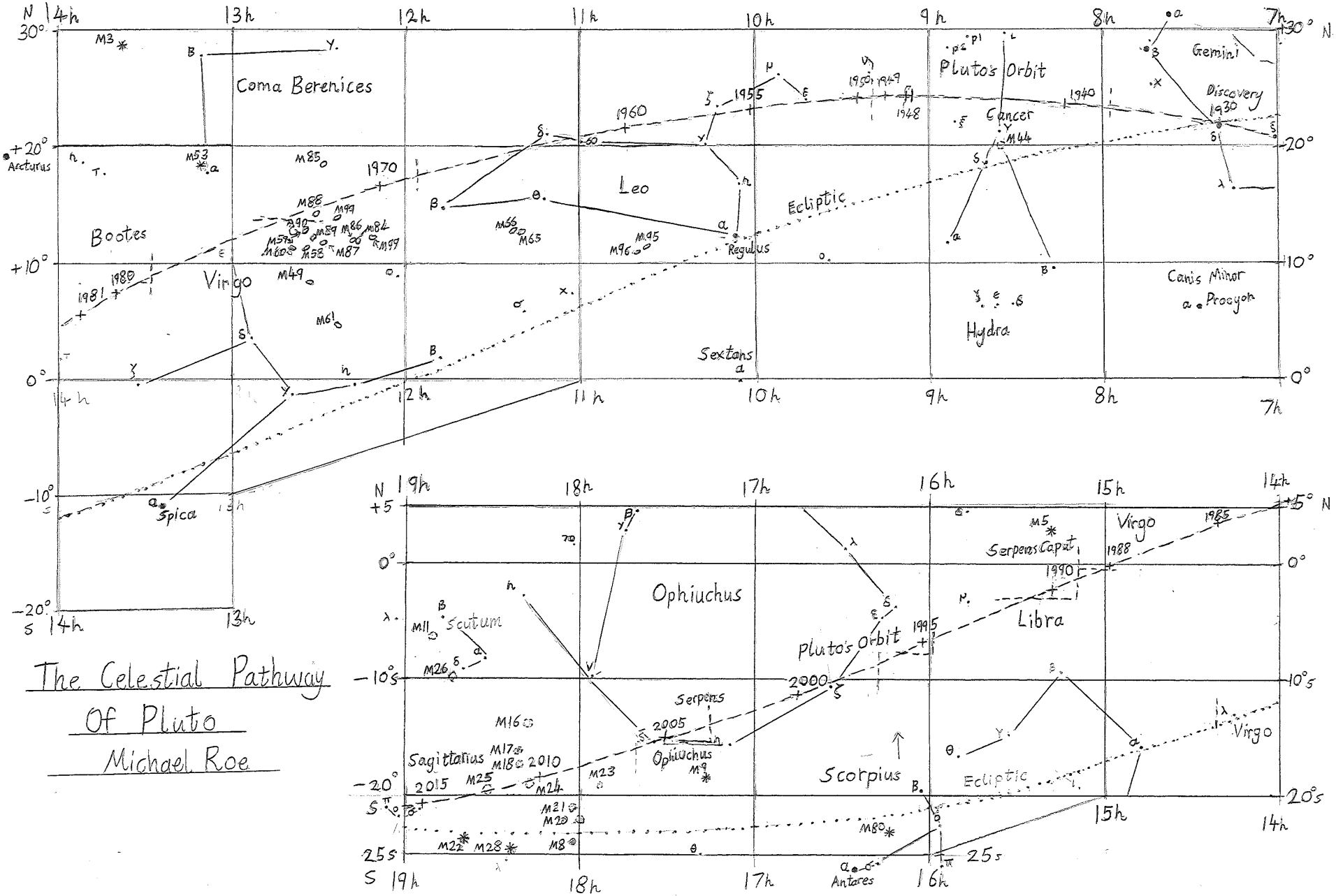
In 1988 the path of Pluto left the huge constellation of Virgo and entered Libra 'the constellation of the scales'. Then in 1989 it passed through Serpens Caput, the constellation of the serpents head. Soon after in 1990, Pluto travelled through Libra again, and in 1989 was at perihelion, its closest point to the Sun, also passing back into the Celestial Southern Hemisphere.

The in 1994 the little planet Pluto went into Ophiuchus 'The Serpent Bearer'. The in 1995, it clipped a corner of Scorpius 'The Scorpion'. In 2006 Pluto left Serpens Cauda 'The Serpents Tail' into Sagittarius ' The Archer', a large constellation. I tied to observe Pluto during 2010, but murky skies defeated even a 12 inch telescope.

In 2010, Pluto passed near the M24 Star Cluster, and M25 in 2011. Now in 2015, it is 21 degrees south near Sigma Sagittarius .

In the future, Pluto will pass the ecliptic again in 2018. Due to its eccentric orbit, it took 88 years to complete half its orbit, but will take 160 years to complete the second half.

(See next page for Star Map)



The Celestial Pathway Of Pluto

Michael Roe

Members Photo's

Rod Cuff

John McCue

Jurgen Schmoll