The Newsletter
of the
Orwell Astronomical Society (Ipswich)

Registered charity No 271313
www.oasi.org.uk

2008 May No 430

Space Mission Related Patches

Peripheral perhaps, but still another facet of the multi level appeal and interests in Astronomy and Space Exploration. Just what is the rationale for space patch aficionados and if one is bitten by the bug, what's out there to collect?

See inside...

Image by Ken Goward, a small part of his own collection

Society News (Roy Gooding)

1 Committing Meeting Saturday 10th May

The next committee meeting will be held on Saturday 10th May from 20:00 at the Methodist Church Hall. This is meeting is open to any member who would like to attend.

2 Events for 2008

This event list will be updated through out the year

Meeting	Venue	Date
Lecture Meeting Sir Fred Hoyle By Dr. Simon Mitton	**BT Adastral Park Martlesham, in the John Bray lecture theatre If is important to register for this meeting. Please see instructions for attending this meeting below**	Thursday 15th May 19:00 start
Excursion	A society excursion will be arranged if there is sufficient interest	No date set yet
Summer Barbecue If you would like to host this years event please contact any committee member	No venue fixed yet	No date set yet
Perseid Meteor watch	The "Dip" Felixstowe	Saturday 16th August
Herstmonceux Astronomy Festival	Observatory Science Centre Herstmonceux, Hailsham, East Sussex,	5th to 7th September
Lecture meeting TBA	Methodist church hall	Friday 12th September From 20:00
FAS Cambridge Convention	Institute of Astronomy, Cambridge	Saturday 20th September
Autumn Equinox Sky Camp Organised by Loughton Astronomical Society with the support of the SPA http://www.starparty.org.uk/	Kelling Heath, Weybourne Norfolk.	Monday 22nd September to Thursday 2nd October Main day Saturday 27th
Lecture meeting To Infinity & Beyond by Andy Green	Methodist church hall	Friday 24th October From 20:00
Lecture meeting William Herschel by Tony Dagnall	Methodist church hall	Friday 14th November From 20:00
Geminid Meteor watch	The "Dip" Felixstowe	Saturday 13th December
Christmas Meal		Wednesday 11th December?

3 Access into the School Grounds and Observatory Tower

Please use the third gate into the school grounds, this is the gate behind the Gym. If the Black door entrance at the base of the observatory tower is locked, you will have to phone

someone in the observatory to let you in. My mobile number is [redacted]. (Roy Gooding) alternatively the Observatory mobile is [redacted] during meeting hours.

4 . Welcome to New Members

Wendy Clegg
Geoff Knight
Liz Oakley

5 Lecture Meeting Venue

Our town lecture venue is now at the Methodist Church Halls, in Blackhorse Lane. The Church has a car park, which can take about 30 cars. Alternatively there is a Park & Display car park at the top of Black Horse Lane, next too the former Town Council Offices. This is about 100 yards from the church.
Black Horse Lane has only one entrance, which is from Elm Street. This is just past the Police Station, if you are arriving from Civic Drive. The church car park is on the right, just past the Black Horse pub.

Meetings start at 20:00, doors open at 19:30

.

7 Lecture Meeting at BT Adastral Park

The East Anglian Branch of the Institute of Physics has invited the society to one of their lecture meetings, on Thursday 15th May, in the John Bray Lecture Theatre. The start time is at 19:00. Light refreshments will be available from around 18:00 in the lecture foyer.

This lecture is collaboration between the Institute of Physics (IOP) and the Institute of Telecommunication Professionals (ITP).

To gain access to BT Adastral Park you will need to register on the ITP web site:

http://www.theitp.org/Events/Events-List?id=1529

- Enter number of tickets you need nominally one.
- Click Continue button in the none member box.
- Fill in registration form.
- Click Continue button.

Any BT staff members who would like to attend will also need to register. If you have any queries please contact either Roy Gooding or Pete Richards.

8 Proposed Society Excursion for 2008

At the last committee meeting it was proposed to have a society excursion if there is sufficient interest from members.

- The first option is to have a return visit to Greenwich
- The second option is to go to Herstmonceux for the 2008 Astronomy Festival on Saturday 6th September

Please contact Roy Gooding if you are interested. An excursion will only be arranged if there are enough members interested to make it financially viable.

Open Weekend

Roy Gooding

Our public Open Weekends have a long society tradition, this being our 36th year, our first one was held back in 1972. The Open Weekend this year was scheduled for Saturday 12th and Sunday 13th April. These events are dependent on what is in visible in the evening sky. The criteria for these events are that the moon must be near 1st quarter with one or more planets visible. This year, 1st quarter was one the Saturday with Saturn and Mars visible to the left and right of the Moon. One thing that is always out of our control is the weather, the evenings preceding the weekend all had periods of clear skies, but could this keep up until the weekend? The weather on Saturday was a mixture of sunny spells and cloud. This persisted into the evening, with sufficient clear periods to give the visitors a full astronomical program.

As usual the evenings program made the use of three observing sites, the principal one being the 10" Tomline refractor. This was supported with, small telescopes and binoculars on the balconies with naked eye and binoculars on the schools playing field. For the second year, John Wainwright had his 8" reflector on the playing field. Martin Cook had the idea of getting the visitors to park in herring bone fashion, round the school drive. This worked very well, it was surprising we had not thought of it before. A few minutes after 19:30, we knew we were in business, six cars arrived in as many seconds, and with the new parking arrangement they had all parked with the same speed. In fact cars were almost multitasking, as 2 cars were able to park at the same time. A total of 50 cars arrived on Saturday.

After some 30 minutes helping with the car parking a member of the school staff joined us, Dan Wood. Dan is in the school's events team, previously I had either emailed or phone him in order to make arrangements for the Open Weekend. This was the first time I had met him face to face. He seemed impressed with our car parking arrangement and mentioned the pyrotechnic display had been put back to 21:15.

The school had been booked for a wedding reception, on the Saturday, that extended into the evening. The evening function would be concluded with a firework display. This was firstly scheduled for a 21:00 slot, but the time kept slipping as the speeches kept over running. They were finally let off at about 21:45. The display lasted for about

10 minutes, with professional size fireworks, an interesting conclusion to our first evening and probably one never to be repeated.

Sunday evening began initially with more cloud cover, than Saturday, but by 21:00 the skies had become quite clear. As is to be expected on a Sunday we had fewer visitors, but we did have a group visits from an unexpected source. At about 20:00 a fire engine arrive at the main gate. The initial reaction was where is the fire, none of the school alarms are sounding. On approaching the appliance I was told that they had come to visit us and fully intended to pay the entrance fee. It appeared to be an evening jolly, or was it? They would not come up immediately as they were expecting more colleagues. They parked in front of the school and waited. Their arrival caused much comment amongst members on car park duty. Ideas ranged from the mundane to the scandalous. Were they here on official business and if so who had invited them, or were they the cabaret act to some ones birthday. After about 20 minutes, sure enough the second appliance arrived. Too our great surprise it was the turntable engine. It took several shunt maneuvers before it was able to enter the school grounds, through the narrow school gates. Orwell Park Observatory now became a temporary out station for the whole of the evening shift from Colchester Road Fire Station. They were on call all the time they were with us, but no emergencies occurred.

The Open Weekend would not have gone smoothly without the help of members. I would like to thank every one who was able to attend. The numbers of visitors was about 190.

OCCULTATIONS DURING MAY

The table lists stellar occultations which occur during the month under favourable circumstances. The data relates to Orwell Park Observatory, but will be similar at nearby locations.

Date	Time (UT)	D R	Lunar Phase	Sun Alt (d)	Star Alt (d)	Mag	Star
11 May	20:56:14	D	0.47+	-10	39	6.6	ZC 1385
12 May	00:05:41	D	0.48+	-20	11	6.8	ZC 1396
12 May	20:13:38	R	0.57+	-5	44	4.4	31 Leo,A Leo
12 May	20:50:30	D	0.57+	-9	40	7.1	Hip 49766
12 May	22:41:34	D	0.58+	-18	26	7.4	ZC 1497
13 May	22:55:35 23:35:41	D R	0.68+	-18 -19	25 20	4.8	58 Leo,d Leo

James Appleton

Night Sky (May)

All times BST

Moon

New Moon	1st Quarter	Full Moon	3rd Quarter
5th	12th	20th	28th

Object	Date	Times		Mag.	Notes
		Rise	Set		
Sun	1	05:34	20:30		
	31	04:51	21:14		
Mercury	1	05:59	22:14	0.4	Mercury is in the evening sky this month. This will be the best evening apparition of the year. Greatest eastern elongation is on the 14th
	31	05:37	21:55		
Venus	1	05:24	19:24	-3.8	Venus stays very close to the sun in the predawn sky this month, making it very difficult to see
	31	04:48	20:58		
Mars	1	10:02	02:34	1.3	Mars will be moving form Gemini into Cancer this month. As it recedes for the earth it will more difficult to see any markings
	31	09:40	01:15		
Jupiter	1	02:01	10:04	2.4	Jupiter remains low down in the predawn sky. Making it difficult to see if you do not have a clear horizon
	31	00:02	08:03		
Saturn	1	13:32	03:55	0.6	Saturn is still well placed to observe this month. By the 31st it will be slipping into the evening twilight sky
	31	11:39	01:58		
Uranus	1	04:14	15:37	5.8	Uranus is low down in the pre-dawn twilight sky
	31	02:18	13:45		
Neptune	1	03:22	13:02	7.8	Neptune is in Capricornus, being visible in the predawn sky .
	31	01:25	11:05		

Meteor Showers

Shower	Limits	Maximum	ZHR
η Aquarids	April 24th to May 20th	May 4th	40
α Scorpids	April 20th to May 19th	April 27th & May 12th	5
Ophiuchids	May19th to July	June 9th June 19th	5

Meteor source is the BAA Handbook

Orroral Valley

by Tina Hammond

30 years after the building of their new Parliament House in 1927, the Australian government was concerned too few people had decided to leave the bright lights of Sydney and Melbourne and migrate to Canberra - which for all intents and purposes was then just a small country town - so in order to create work for the locals and attract people to its embryonic capital it entered into a contract with NASA.

In 1960 the USA and Australia signed the Umbrella Agreement (which is still in force) which stated that Australia would build three tracking stations within close proximity of Canberra, which the Australian government would establish and operate on behalf of NASA, who would always have overall control of them. They were strategically placed to be far enough from the centre to be free of radio interference, etc. However, because of the relatively close proximity to the city centre – no further than 50 km – many jobs would be created for a local workforce. Both countries, it seemed, would benefit.

It was thus that Australia found itself at the forefront of the rapidly advancing - and arguably the most exciting – period of space exploration and the 'space race' travel which epitomised the 1960s.

Tidbinbilla, Orroral Valley (ORV) and Honeysuckle Creek (HSK) were all chosen for very different reasons, and had different objectives and purposes. Tidbinbilla, which was

handy to use a remaining stone as the basis for a barbecue!

chosen for its sensitivity, was to be the Deep Space Network (DSN); the flexibility of Orroral Valley made it ideal for Satellite Tracking And Data Acquisition (STADAN); and the third, Honeysuckle Creek, for its reliability in the very important Manned Flight Space Network (MSFN).

Tidbinbilla was 35 - 40 km SW of Canberra, and Honeysuckle Creek 32 km SSW. Just beyond HSK was the Orroral Valley tracking station, which was NASA's first STADAN facility in Australia. Unlike Honeysuckle's long range antenna, Orroral specialised in flexibility, and was able to switch from tracking one satellite to another rapidly. The 40 acre site was chosen in 1963 and bought in 1964.

Building at ORV was completed by May 1965, and tracking commenced there in October 1965, several months before it was officially opened on 24 February 1966.

As part of STADAN, it had sister stations at Fairbanks, Alaska and Rosman, North Carolina. ORV was involved in the joint USA/USSR Apollo/Soyuz project in 1975, which saw them link up when orbiting the earth.

Orroral was instrumental in tracking the space shuttle Columbia in its maiden voyage in April 1981. It continued to support the shuttle mission until, as NASA continued to consolidate its Australian facilities, it had no further use for ORV by the mid 1980s, and it was transferred back to Commonwealth ownership in March 1985, when the equipment was taken away by NASA. It was closed in

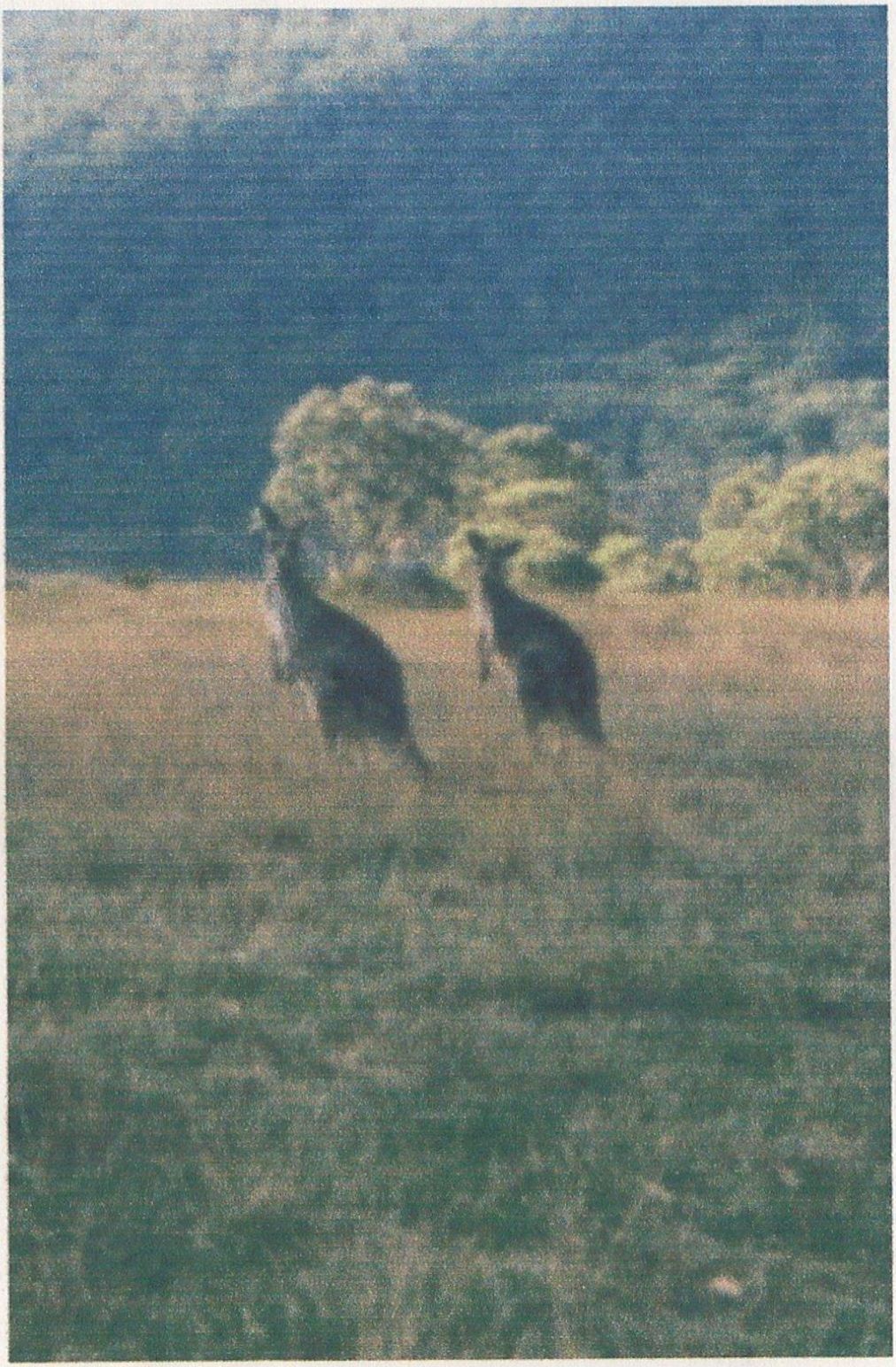
home to many kangaroos

home to kangaroo

December 1985, and the ruins became part of the newly created Namadgi National Park.

Oddly, the site was not bulldozed until 1992, so I imagine it must have looked very incongruous for seven years in what was by then a designated nature reserve, and must have acted as a surreal home to many indigenous species of wildlife.

On a ridge to the south of the ORV site was a lunar laser installation which reflected pulses of light from mirrors which had been placed on the moon's surface by the Apollo missions. Known as the Geodetic Observatory this facility did not close until as late as 1999, although such tests continue to be carried out in the USA today.



kangaroos

Not a patch on the real thing – *well...*

By Kenneth J. Goward FRAS

As has often been said within these pages, the science and hobby of astronomy has many facets and one astronomer's meat can be another's poison – so to speak. We as members of OASI take this on board and in so many words at the top of our web site home page make it clear that membership is open to anyone and that we cater for eclectic individual interests – anything from dedicated 'glued to the eyepiece' observation through to the armchair aficionado with our range of interests encompassing space exploration too.

The purpose of this article is to highlight an interesting offshoot from such a broad spectrum, one that has – *for me* – become something of an enjoyable pursuit, an adventure and a learning experience to boot. You see, since having finally plucked up the courage to get on an aeroplane (hitherto I had always worked to the principle that if we were meant to fly – we'd have been born with feathers) and visited the Kennedy Space Center last summer and having spent a portion of that visit enjoying a liberal dose of retail therapy within the superb space shop there, I have taken up collecting embroidered Space Mission Patches – of which there is a simply vast amount available. That being so, and given my more than 40 year fascination with the Apollo project, unless possessed of unlimited financial resource one has to specialise – so no prizes for guessing where my interest tends...

Information/Reference Sources

Before going on to look at what's out there to find it may be worth explaining how these patches came about. There is very little in print to guide one along the way and probably the best of what is available is contained in a 128 page book published over in the USA in 1986 entitled 'Space Patches From Mercury to the Shuttle' by Kaplan & Muniz. Long since out of print, but the occasional copy comes to light within the book trade (try **www.abebooks.co.uk**.). By far the best and to my mind most authoritative reference source available on the internet may be found at **http://genedorr.com/patches/Intro.html.**

History

The mission patch tradition evolved within the US military by crews desiring to personalise their missions and their own part within them. Largely the province of aviators and given that the early astronauts were drawn from those ranks, it's hardly surprising that such symbolism gained a foothold in the American space programme. The original seven Mercury Astronauts all gave names to their capsules, but no patches were produced

and those one sees available today are modern interpretations based upon the capsule names.

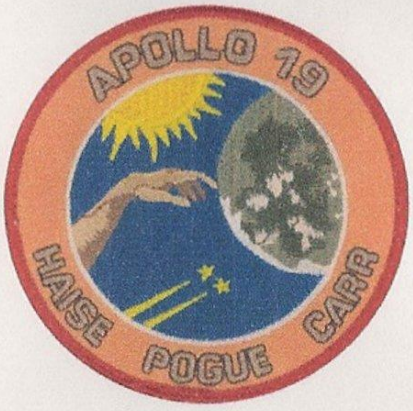
It was not until Gemini V (Gordon Cooper & Pete Conrad) that crew patches were sanctioned by NASA, although Conrad – an irrepressible, free spirited wag – first suggested a patch depicting a settler's wagon with the somewhat irreverent words *'8 DAYS OR BUST'* on the tarpaulin, which slightly vexed his bosses as there was a concern that if the planned eight day mission had to be curtailed, the media would seize upon it as a bust. The settler's wagon patch was adopted, albeit without the 8 days reference – so much for thinking 'spin' is a modern irritation! Henceforth the tradition grew and flourished to the present day with every crew designing and wearing a patch to signify something about their mission.

Incidentally, Conrad went on to command the almost flawless Apollo 12 mission* – the one during which they precision landed within a short walk of an earlier American soft landed probe, Surveyor 1, on the Ocean of Storms (Oceanus Procellarum) and successfully recovered a piece of the probe to take back for study. Sadly, Pete Conrad died in a motorcycle accident in 1999.

* The one major glitch in the mission occurred within a few seconds of lift-off, when lightening struck the 1st stage engines and the craft lost all electrical instrumentation function for a brief few seconds. Thereafter stringent rules have been applied to all manned launches where rain or clouds suggest the possibility of such strikes – a major reason why Shuttle launches are frequently delayed these days.

Some Apollo patches designed and intended for missions that were subsequently cancelled due to Congress imposed cutbacks in the NASA budget.
The patches are highly sought after
and - frustratingly – not <u>yet</u> in my own collection!

Apollo 18



Apollo 19

Apollo 20

What to look for – and what to avoid

Patches are not just available for manned missions these days. There are, for instance, some delightful ones designed for the Mars Spirit and Opportunity missions, New Horizons (Pluto) and legion others from all space-faring nations. Various space hardware manufacturers produce their own versions – patches related to Grumman's Lunar Module contract

being particularly desirable to collectors. Be aware that the majority (not all) of patches available through the likes of eBay and other outlets are modern reproductions or even commercially produced by the patch makers themselves to mark whatever loose space connection may be opportune. Many of these are otherwise excellent examples and I am under no illusion that the majority of my own collection are not 'genuine originals'. By and large if you purchase patches through NASA shops or recognised commercial dealers like CollectSpace.com or otherwise obtain patches made by firms such as 'Lion Bros' or 'AB Emblems' you won't be straying too far *'off piste'*. Generally, too, the 4" diameter patches are closer to authentic and more collectable, the smaller 3" ones often being churned out en masse for the 'punters' by sweat shop labour. Many patches are produced for support staff to mark their own official sphere of involvement; e.g. Mission Control, launch pad technicians, Fire and Security amongst many. If one desires to own REAL patches, then I would suggest you'll need a fat cheque book to match. NASA Astronauts have over time been allowed to carry a few mission patches each on their various space flights. These so-called 'flown patches' where the provenance can be verified fetch significant sums – obviously the more landmark or famous the mission, the more valuable the item. It is possible to obtain silk screen printed patches on fireproof material known as 'Beta Cloth' - space suit material, although most of these patches are of second quality. As a matter of interest, sewn on woven and embroidered patches are not worn on the Astronaut's suits or overalls during missions due to fire risk, they are intended for non flying apparel, pre and post mission publicity and mission support staff. So with that understanding – you pays your money and you takes your choice – ***caveat emptor...***

Specialising

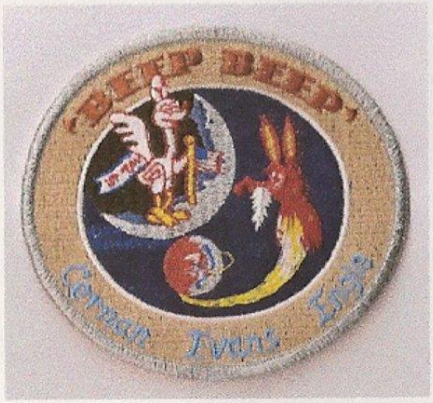
As previously alluded to, my specific interest in terms of Mission Patch collecting is anything – and everything to do with the NASA Apollo Programme. Each of the manned missions, including the ill-fated Apollo 1 had its own patch, but Apollo 2 through 6 (as the Americans would say) were unmanned proving tests of the Command & Service Module (CSM), Lunar Module (LM) and Saturn rocket booster systems that to the best of my knowledge were not given any logo. Having said that, there was a very hard-to-find, but attractive patch designed by Grumman (the LM contractors) produced for Apollo 5, an unmanned initial testing flight for the Lunar Module – depicting the LM minus its landing legs at the point of ascent stage motor firing and separation from the descent stage.

Dedicated people though they were, humour and windups were part and parcel of the day to day scheme of things within the programme – and you'll not find a better source book for such tales than the autobiography

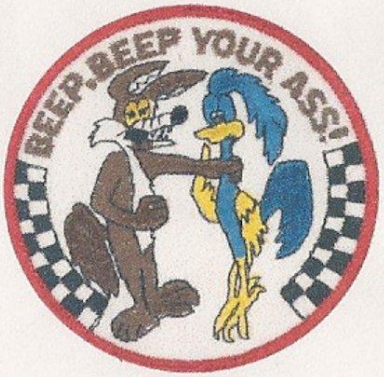
written by one of Apollo's most endearing characters, Guenter Wendt, who was the white room pad leader at the launches. Entitled 'The unbroken Chain' and published by Apogee Books in 2001.

Not specifically mentioned in the above tome was the well meant rivalry between the Apollo 14 Prime and Backup Crews. The Backup crew, amongst who was Gene Cernan of Apollo 10 and 17 (the last man, thus far, to have walked upon the moon) have their own place in history, insofar as they had the only dedicated Backup Crew patch of the entire programme. Designed and produced by the Prime Crew, including the Commander Al Shepard who was the first American into space, they had a patch made up based upon their own but showing the cartoon character 'Road Runner' standing on the lunar surface and a burnt out 'Wily Coyote' chasing after him! Not to be outdone, the Backup crew got at least as far as having some artwork produced for a sarcastic reply, but its uncertain that the artwork was ever translated into an actual patch – see below…

The official Apollo 14 Mission Patch



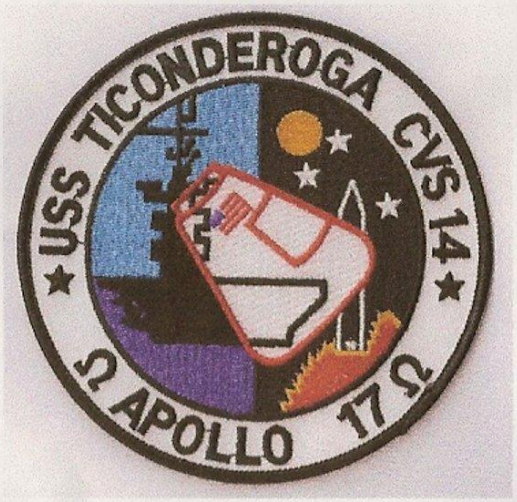
The Backup crew joke patch



Artwork for the Backup Crew reply patch - Charming!

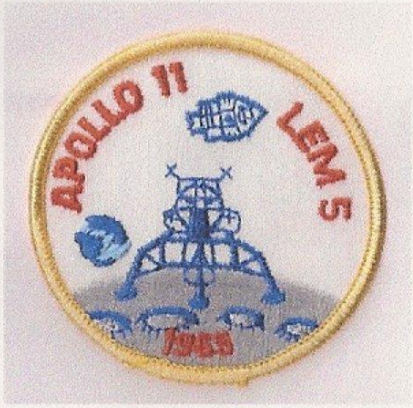
Not to be outdone and certainly an integral part of the Apollo Programme, the United States Navy produced its own mission-related patches for the Capital ships involved in the recovery of the Command Modules and their crews at the conclusion of each mission.

Recovery Patch for the Apollo 12 Mission, USS Hornet



Recovery Patch for the Apollo 17 Mission, USS Ticonderoga

The Lunar Module has been a popular subject for the patch makers over the years – see cover for a colour picture of another produced by Grummans.

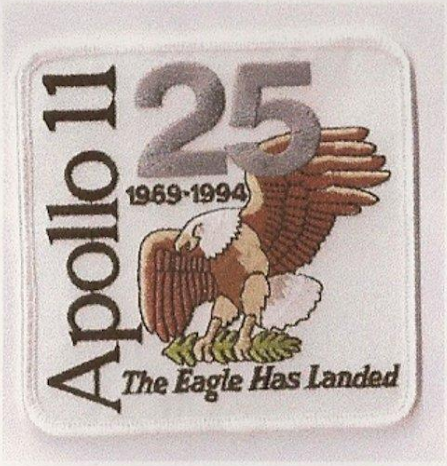


Patch depicting Lunar Module No 5, the one used for the first manned landing (Apollo11)

Also popular are the various commemorative patches issued for the Apollo 11 mission.

First Manned Lunar Landing – 1969, July 20th

25th Anniversary of the first Lunar Module landing (LM No 5, Apollo 11)



25th Anniversary of Apollo 11

Conclusion

As mentioned at the outset, the purpose of this article is to describe yet another offshoot from our main interests and if anyone has been inspired to begin their own collection tailored to whatever suits one's individual taste, then more to the good. It may seem akin to train spotting to some, but be assured there is quite a bit of history to be gleaned from those patches – and the fun of the chase along the way.

Conversely, my dear wife says I should get out more – and who am I to argue with sage wisdom!

Are you sitting comfortably?

Paul Whiting *FRAS*

It's that nice cosy feeling when you get back from a hard day at the office or back from shopping when you slouch down on the settee and put your feet up and let the world move around you. You feel quiet and tranquil in the knowledge that for a few moments you can rest easy, perfectly still. But exactly how still are you?

Let us think about this for a minute. The Earth is rotating, once in 24 hours (near enough). That means that if you live on the equator you are actually moving at around 1000 mph (1600 kph). OK we in Suffolk don't go at quite this speed, but it is still a fair lick.

So that's our daily motion – what about our yearly motion? The Earth travels around the Sun every 365 (ish) days at a rough distance of 93 million miles. To achieve this annual rotation the Earth must travel at a speed of 66,000 mph (106,000 kph).

So adding these two components we could be travelling at around 67,000 mph ! But wait. The Sun is nomadic and is wandering around the galaxy. To measure this we must define a "local standard of rest", which we do by considering the average motion of our nearest neighbourhood stars. Relative to this local standard, the Sun (with us in tow) is moving at about 43,000 mph (69,000 kph). Which means that at times we could be travelling at up to 110,000 mph !

Let us now consider the Milky Way galaxy. It rotates. It takes the Sun approximately 225 million years to make one revolution (our "galactic year"). To achieve this the Sun (and us) must travel at 483,000mph (773,000 kph).

Is that it? No! Galaxies move throughout the universe, and the Milky Way is no exception. We have to define a new frame of reference against which to measure our movement, and this is defined against the Cosmic Background Radiation (the echo of the Big Bang). It turns out that the Milky Way is travelling at around 1.3 million mph (2.1 million kph). We are moving towards an area roughly defined within Leo and Virgo, because (it is thought) of a great mass accumulation in that direction exerting a high gravitational force on us and our neighbouring galaxies. This is sometimes called "The Great Attractor".

So I make that 1,893,000 mph and I didn't even break into a sweat. Note that this is still a 350th of the speed of light so no need to panic.

[based on an article of the Astronomical Society of the Pacific]

OASI Committee Contacts & Responsibities

Kenneth J. Goward FRAS	**Chairman**	☎	
Roy Gooding	**Secretary**	☎	**MAIN POINT OF SOCIETY CONTACT** Press Publicity with Chairman. Observatory Decoration. Visits by potential new members.
Paul Whiting FRAS	**Treasurer**	☎	**Finance.** Supervision of Grant Applications. Visits by outside groups. **IYA 2009 Coordinator**
James Appleton	Committee	☎	Committee Meeting Minutes. Web Site.
Martin Cook	Committee	☎	Membership. Tomline Refractor Maintenance.
Neil Morley	Committee	☎	Equipment Curator.
Peter Richards	Committee	☎	Lecture Meetings. School Lighting liaison. Email Distribution Lists.
Eric Sims	Committee	☎	Newsletter.
Mike Whybray	Committee	☎	Librarian & Workshops.
Bill Barton FRAS	Committee	☎	Safety & Security.
John Wainwright	Co-opted	☎	Forward planning & Strategy

IYA 2009 – ADVANCE DATES NOTICE

- Monday March 30th - Sunday April 5th - **Saturn Week**
- Monday July 20th - Sunday July 26th - **Moon Week**
- Monday October 26th - Sunday November 1st - **Jupiter Week**

Diary for May

Wednesdays **FROM 8PM**	**MAIN OBSERVATORY CLUB NIGHTS** **Primary Observational targets: Nebulae and faint objects.** ☎ Martin Cook [redacted] (mobile) [redacted] ☎ Roy Gooding [redacted] (mobile) [redacted]
Saturday 10th **8pm** Methodist Church Hall Blackhorse Lane Ipswich	**OASI COMMITTEE MEETING** Any member is welcome to attend. ☎ Roy Gooding [redacted]

Society Primary Contacts

Chairman: Kenneth J. Goward FRAS ☎ [redacted] (daytime & evenings)
Secretary: Roy Gooding ☎ [redacted] (daytime) [redacted] (evenings)
E-Mail queries: Ipswich@ast.cam.ac.uk

Society Trustees

Mr Roy Adams Mr David Brown Mr David Payne

Society Honorary President

Professor Allan Chapman D.Phil MA FRAS

Observatory Telephone Number

Meeting nights only

[redacted]

Thank you to all those members who so generously gave of their time and effort to help out at this year's successful Public Open Weekend on 12th & 13th April. The skies were kind to us and approx 189 visitors attended.
Moreover, we are delighted to welcome three new families to our membership.

John Isaac Plummer, Colonel Tomline's Astronomer Part 2

1.1 Plummer's Astronomical Work And Publications

Plummer's publications amounted in total to 68 papers and short communications on astronomy, one textbook on the subject, a letter to *Nature* on araucaria cones and a pamphlet on typhoons. The main methods employed in identifying Plummer's publications were as follows:

- Mike Barriskill & Charles Radley undertook a manual search of the RAS Library in 1979; Roy Gooding did so again in the 1980s and Paul Whiting did so in 2003.
- At the request of Ken Goward [2005a], Professor P Kevin MacKeown of Hong Kong University revised a draft list of Plummer's publications.
- At the request of Ken Goward, Leung Ming Wo of the Hong Kong Observatory undertook a search of files in the Hong Kong Public Records Office.
- The author of the present document identified publications by Plummer using the NASA/Smithsonian ADS[1] digital library for physics and astronomy, the British Lending Library electronic catalogue, the Google Internet search engine and in references within other documents.

For the convenience of modern readers, the text below details times and dates of observations by Plummer and his contemporaries in modern form, rather than in the original reported form. Nineteenth century astronomers reported times of observation in Greenwich Mean Astronomical Time (GMAT), which is Greenwich Mean Time counted from midday – it has the advantage for astronomical purposes of not involving a change of date in the middle of the night (see e.g. [1979a]). Modern astronomers do not use GMAT, therefore below all observation times originally reported in GMAT are converted to GMT using the formula

$$GMT = GMAT + 12^h.$$

Note that this conversion advances some dates by one day. For example the epoch of occultation disappearance of c Leonis reported by Plummer [1869c] as 13h 54m 23.9s (GMAT) on 16 Dec 1867 becomes 01h 54m 23.9s (GMT) on 17 Dec 1867 (see Appendix 5.1).

[1] National Aeronautics and Space Administration / Smithsonian Institute Astrophysics Data System accessible over the internet at http://adsabs.harvard.edu/index.html.

To facilitate comparison of observed event times reported in Plummer's era with modern estimates of event times, GMT is equated with UT. This approach is not rigorously exact, however, given the inevitable problems with establishing an accurate timing reference for observations made in Plummer's era, it is as accurate as can reasonably be achieved.

Plummer and his contemporaries used imperial units in their publications. Below, except in quotations from papers of Plummer's era, quantities are expressed primarily in SI[2] units with imperial equivalents given parenthetically – to prevent spurious numbers of significant digits a degree of approximation is accepted in converting between units as appropriate.

In reviewing Plummer's work, it is instructive in some cases to compare his description of a phenomenon with a modern calculation of the circumstances of the phenomenon. Appendix 19 describes the reference material used in the modern calculations.

Table 2, compiled from Plummer's published papers, summarises his astronomical work and publications.

[2] Système International, informally the "metric system".

Year	Location	Observations	Publications	Notes
1866	Glasgow	Leonids	None known	Thirty-three years earlier, the 1833 Leonids had provided possibly the most spectacular meteor display on record. As a result of the 1833 Leonids, astronomers observed the 1866 Leonids keenly, hoping for a repeat performance!
1867	Glasgow		Observations of Leonids 1866 [1867b]	
	Durham	Lunar occultations	None known	
1868	Durham	Transit of Mercury, 05 November 1868. Minor planets. Comet Winnecke (C/1868 L1). Lunar occultations.	Observations of transit of Mercury, 05 November 1868 [1868a]	
1869	Durham	Minor planets. Comet Winnecke (C/1868 L1). Spectroscopy of an Aurora Borealis.	Observations of: • Minor planets [1869b]. • Comet Winnecke (C/1868 L1) [1869b]. • Lunar occultations [1869c]. • Spectroscopy of an aurora borealis [1869e]. Estimating local circumstances of an occultation [1869f].	

Year	Location	Observations	Publications	Notes
1870	Durham	Minor planets. Comet II 1870, Coggia's (C/1870 Q1).	Observations of minor planets [1870a]	
1871	Durham	Minor planets	Observations of: • Comet II 1870, Coggia's (C/1870 Q1) [1871a]. • Minor planets [1871b].	
1872	Durham	Estimates of the diameter of Venus.	Observations of minor planets [1872a]	
1873	Durham	Henry's Comet (C/1873 Q2).	Textbook on astronomy [1873a]. Projection of stars on the lunar limb during occultations [1873c, 1873e]. Discussion of estimating the figure & diameter of Venus during the transit in 1874 [1873g]. Estimates of the diameter of Venus [1873h].	

Year	Location	Observations	Publications	Notes
1874	Orwell Park	Aurora. Zodiacal light. Comets.	Correspondence regarding a so called *meteor cloud* [1874b]. Observations of: • Henry's Comet (C/1873 Q2) [1874c]. • Zodiacal light [1874d].	Plummer was appointed to Orwell Park Observatory in June 1874. The chief duty of the Observatory was to be observation of comets. Plummer noted that the observatory was fully equipped and for the most part in working order. Regarding the equatorial refractor, he noted that: *The form of mounting renders this instrument one of the most easily worked of its size yet erected*. He also indicated that Orwell Park was to *be furnished with spectroscopic appliances* [1874d] although in fact it appears that the equipment was not provided, as Plummer published no papers on spectroscopic observations while at Orwell Park.
1875	Orwell Park	Encke's Comet. Observations to determine the longitude of Orwell Park. Stars with supposedly irregular proper motions.	Observations of comets [1875a]. Personal equation of the observer [1875c]. Review of the nebular hypothesis [1875d]. Annual report to the RAS for 1874 [1875e].	

Year	Location	Observations	Publications	Notes
1876	Orwell Park	Brilliant meteor. Brightness of Venus. Conjunction of Venus and Lambda Geminorum. Completion of observations to determine the longitude of Orwell Park. Transit observations of stars with suspected irregular proper motions. Transit of Mercury, 06 May 1878.	Observations of: • Brilliant meteor [1876a]. • Brightness of Venus [1876f]. Critique of the accuracy of contemporary star catalogues [1876b]. Proposals for new nomenclature for minor planets & stars [1876c]. Annual report to the RAS for 1875 [1876d].	Plummer was elected a Fellow of the RAS. Prior to this date, Plummer arranged for colleagues, already members of the RAS, to communicate his work to the Society. Once Plummer became a member of the Society he contributed his papers under his own name.
1877	Orwell Park	Photometry of the lunar eclipse, 23 August 1877. Comets.	Observations of: • Conjunction of Venus and Lambda Geminorum [1877a]. • Photometry of the lunar eclipse, 23 August 1877 [1877e]. Distribution of the fixed stars [1877d, 1877g]. Annual report to the RAS for 1876 [1877b].	Plummer [1878c] complained that *the want of astronomical literature, and particularly of star catalogues, is found to be a great drawback…*

Year	Location	Observations	Publications	Notes
1878	Orwell Park	Comets. Transit observations for determination of the longitude of the Observatory. Transit of Mercury, 06 May 1878.	Age of the Sun in relation to evolution [1878b]. Supposed influence of Orwell Park Observatory equatorial pillar on errors of the transit instrument [1878d]. Observations of transit of Mercury, 06 May 1878 [1878e]. Annual report to the RAS for 1877 [1878c].	Poor weather enabled Plummer to concentrate on reducing results of previous observations. The declination axis of the equatorial refractor jammed. Mr Simms (of Troughton & Simms) dismounted the telescope and removed rust from the bearings. Completed determination of the longitude of the Observatory [1879b].
1879	Orwell Park	Comets	Observations of: • Comets [1879a]. • Projection of Mercury on the Sun's corona during the transit, 06 May 1878 [1879c]. Annual report to the RAS for 1878 [1879b].	
1880	Orwell Park	Comets. Eclipse of the Sun, 31 December 1880. Lunar occultations.	Observations of comets [1880a, 1880c]. Composition of meteorites [1880d]. Height of the aurora [1880e]. Annual report to the RAS for 1879 [1880b].	

Year	Location	Observations	Publications	Notes
1881	Orwell Park	Comets. Conjunction of comet 1881b (C/1881 K1) with a star.	Conjunction of comet 1881b (C/1881 K1) with a star [1881b]. Annual report to the RAS for 1880 [1881c].	Plummer [1882b] complained in 1881 that many of his positional estimates depended on old catalogue places of stars. He expressed serious disenchantment with the Orwell Park Observatory transit instrument as follows: *…the Observatory not being furnished with a meridian instrument suitable for the observation of the comparison stars*.
1882	Orwell Park / Bermuda	Comets. Transit of Venus, 06 December 1882. (Plummer observed as a member of the ROG expedition to Bermuda).	Observations of comets [1882a, 1882c, 1882d]. Annual report to the RAS for 1881 [1882b].	
1883	Orwell Park	Comets	None known	
1884	Orwell Park	Comets. Weather conditions prevented observation of occultations during the lunar eclipse 04 October 1884.	Observations of comets [1884b, 1884c]. Annual report to the RAS covering 1882 & 1883 [1884a].	
1885	Orwell Park	Comets	Observations of comets [1885b]. Annual report to the RAS for 1884 [1885a].	

Year	Location	Observations	Publications	Notes
1886	Orwell Park	Comets	Observations of comets [1886a, 1886b].	An illness during 1886 interrupted Plummer's observations.
1887	Orwell Park	Comets	Observations of comets [1887b]. Annual report to the RAS for 1886 [1887a].	
1888	Orwell Park	Comets. Cloud prevented observation of occultations during the lunar eclipse 28 January 1888.	Observations of comets [1888b, 1888d]. Annual report to the RAS for 1887 [1888a].	
1889	Orwell Park	Comets	Observations of comets [1889b, 1889d]. Annual report to the RAS for 1888 [1889a].	Mechanical failure again hampered Plummer's observations during 1889 [1890a]. While searching for Barnard's Comet (1889 II) on 01 July 1890, the declination axis of the equatorial refractor jammed. On 19 August, Mr Simms (of Troughton & Simms) reground the axis and restored correct operation. Colonel Tomline died on 25 August 1889 after an illness of eight months. In his final months, Tomline had recognised that his successor was unlikely to retain an operating observatory, and therefore had taken steps to close Orwell Park Observatory.

Year	Location	Observations	Publications	Notes
				Following Tomline's death, Plummer found himself with only a *very limited time* within which to undertake further observations and to complete the reduction and publication of all outstanding observations.
1890	Orwell Park and 8 Constitution Hill, Ipswich	Comets	Observations of comets [1890b]. Stellar distance scale [1890d]. Annual report to the RAS for 1889 [1890a].	Plummer left Orwell Park in summer 1890 and moved to 8 Constitution Hill, Ipswich. Once he had moved to Ipswich, he completed reduction of the outstanding cometary observations and on 10 November 1890 drafted his final observing report [1890b] on work undertaken at Orwell Park Observatory. Plummer published his last astronomical paper [1890d] on 04 December 1890.
1891 - 1911	Hong Kong Observatory	Transit observations to determine stellar positions	Plummer contributed to the Hong Kong Star Catalogue (epoch 1900.0) and associated publications [1900a, 1902a, 1905a, 1907a].	

Table 1. Overview of Plummer's astronomical work and publications.

1.2 Plummer's Ability As An Astronomer

Plummer's publications shed light on his ability as an astronomer. During his time at Glasgow, Durham and Orwell Park Observatories he published 68 papers and short communications on astronomy and one textbook on the science. His publications covered a wide variety of astronomical topics, both theoretical and practical. During the early part of his astronomical career, at Glasgow and Durham Observatories, he engaged with some of the leading people and ideas of the age in astronomy. He was one of the first astronomers to observe the spectrum of an aurora.

All of Plummer's publications except one were well-written, clear and concise, a style exemplified by his textbook [1873a]. The one exception [1876b] was his first report into the quality of positional data in the BAC (British Association Catalogue) of stars, in which he conspicuously failed to explain clearly the methodology that he used to compare stellar positional data in two catalogues.

The majority of Plummer's publications, particularly those dealing with straightforward observations, describing the standard theories of the day, or providing relatively straightforward analyses of data are satisfactory and are comparable with the equivalent publications of his contemporaries.

However, much of Plummer's work as an astronomer was concerned with the reduction and analysis of data, and it is in this area that some of his publications displayed serious problems. His observing reports generally contain sufficient explanation and tabulation of data to facilitate a thorough reworking and checking of his data reduction using modern values for astronomical constants and a modern ephemeris for the position of celestial bodies. Checking Plummer's work in this way reveals that his data reductions were very variable in quality. Of course he worked in an era without the computational aids that we take for granted nowadays, and had to undertake all data reduction by hand, without an assistant. In order to reduce the computational burden, he sometimes utilised approximate calculations. Unfortunately, some of his publications involving complex observations or data reduction betray serious mistakes in technique, numerical errors in analysis and excess numerical approximations (e.g. [1876f]).

Although some of Plummer's hypotheses and ideas appear speculative from a modern standpoint, they were not generally out of step with the thinking of his era. However, in some of his publications he betrayed a tendency to propose explanations uncritically and without adequate investigation.

Unfortunately, in a few instances, Plummer's publications are not consistent one with another, and it seems that in preparing some material for publication he simply did not refresh his memory of his own previous publications or observing notes on the subject in question.

When Plummer began work at Orwell Park Observatory he stated [1875e] that the primary aim of the facility was to be the observation of comets. He was very successful in this aim, publishing observations and attempted observations of 49 comets while at the

Observatory. However, in other areas of astronomy he appears not to have had a clear programme of activity or set of goals. Perhaps as a result of this he started several lines of enquiry which he did not bring to a satisfactory conclusion.

The main difficulties with Plummer's publications are summarised below. Note that this summary is not intended to detract from the huge amount of excellent astronomical work that Plummer undertook – however it does help to provide a rounded view of his astronomical career and abilities.

1. Observations of Venus and its factor of irradiation

Plummer demonstrated an interest in Venus throughout his astronomical career. He expended much effort in estimating the effect of *irradiation* on the apparent diameter of the planet. *Irradiation* [1970a] is a phenomenon whereby a bright object, e.g. a planet or the lunar limb, tends to encroach upon a dark background to an extent that is proportional to the difference in intensity. It is a physiological effect caused by the spreading of excitation from the retinal area stimulated by the brighter object. As a result, a planetary disk can appear larger in the eyepiece than it does photographically. Unfortunately, Plummer's publications of observations of Venus provide evidence of several lapses.

In March – June 1868, Plummer [1873g] undertook observations of the apparent diameter of Venus and obtained an estimate of irradiation very much larger than that of Main [1856b], who had based his estimate on a very large number of observations made at the ROG during an 11 year period. As a consequence, Plummer did not publish his results and in 1873 he repeated his observations with *greater care and precaution*.

In 1873, he published [1873h] the culmination of his efforts to estimate the apparent diameter of Venus and the effect of irradiation. He hoped to eliminate the possible effect of temperature on irradiation by making his observations during the period of the year when temperature was generally increasing with Venus attaining its maximum apparent diameter approximately at the middle of the period. Plummer recorded the ambient temperature at the time of each of his observations and concluded that his data indicated that there was no significant effect of temperature on irradiation – unfortunately, Plummer's conclusion was not justified, as he made no attempt to identify any possible interaction between the two quantities. (In fact, a more rigorous modern analysis of Plummer's observational data does validate his conclusion that there was no significant effect of temperature on irradiation.) Plummer also gave some anecdotal evidence to justify his belief that irradiation depended on atmospheric transparency; however, this was far from compelling and it is not at all clear why he did not attempt a more rigorous investigation, for example by estimating the transparency of the atmosphere on a quantitative basis and using a regression model to estimate how well it predicted the irradiation.

In 1877 Plummer [1877a] published an analysis of observations of a close passage of Venus to the star Lambda Geminorum on 18 August 1876. Although poor sky conditions spoiled Plummer's observations, he analysed his data to provide an estimate of the irradiation of Venus and its variability over short timescales. In performing the

data reduction, Plummer normalised the estimates of irradiation about a value which was presumably intended to be the mean value of irradiation during the period in question. However, in calculating the mean value, Plummer did not take proper account of the sign (+ or -) of some of the estimates of irradiation. The net result of this was to provide a false baseline for the subsequent data analysis; however, as Plummer was interested primarily in the variability of irradiation, rather than its absolute value, the apparent mistake did not vitiate his conclusions.

The three papers provided the following estimates of the irradiation of Venus:

[1873g] An unsatisfactorily large value which prevented publication of results.

[1873h] Point estimate: -0".546. Suspicion that atmospheric transparency affected irradiation.

[1877a] Average value: -0".412. Considerable variability (range -1".61 to +0".64) around the average, determined by the brightness of the sky and cloud cover.

Plummer did not bring his studies of the irradiation of Venus to a satisfactory conclusion, or provide a reconciliation of his various estimates of irradiation. Appendix 8.2 provides more details.

2. Brightness of Venus

In 1876, Plummer [1876f] constructed a simple photometer and used it to estimate the magnitude of Venus, and the relative brightness of Venus at greatest brilliance to that of the mean Full Moon. Unfortunately, Plummer's data reduction was badly flawed. His tabulation of the raw observational data indicated a very significant random variation in his measurements which propagated through the subsequent analysis to vitiate the conclusions. Plummer compounded this problem by several straightforward errors in his data reduction: inconsistent corrections for atmospheric extinction; confusion over readings from the photometer (mistaking estimates of intensity for their reciprocal values); and excessive numerical approximation. The net effect of these problems was to invalidate Plummer's conclusions. Appendix 8.3 provides more details.

3. Lack of reference to previous observations or reports

Plummer suffered three serious lapses in which he appeared to prepare papers without relating them to his earlier publications or observing reports on the same subjects:

a) He reported observations of the transits of Mercury on 05 November 1868 and 06 May 1878. To observers in the UK, the 1868 transit began before the Sun rose over the UK, and only the last hour and a half of the event was visible. In 1878, the situation was reversed, and from the UK only the ingress phase of the transit was visible. In his report of the 1878 transit, Plummer [1878e] noted that at 2nd contact, the limb of Mercury appeared to disengage more rapidly from the solar limb than anticipated. He stated that he remembered the same effect during the 1868 transit –

clearly this was a case of his memory playing tricks! Appendix 2 provides further details.

b) He gave significantly different accounts of his observation of the occultation disappearance of Gamma Tauri on 28 March 1868 [1869c, 1873c]. In the earlier paper he reported that the star appeared attached to the limb of the Moon for at least five seconds before it disappeared (this was an example of the phenomenon of *projection on the limb*) whereas in the later paper he stated that the star appeared inside the lunar disk by a "considerable distance". In the later paper he also referred to the star incorrectly as Zeta Tauri! Appendix 5.3 provides further details. See immediately below for further difficulties in relation to the supposed phenomenon of projection upon the limb.

c) He undertook observations of Palisa's Comet (1879 V) during the period 10 September – 15 October 1879. In his first paper [1880c] on his observations, he commented on a peculiarity in the brightness of the comet near perihelion. He expressed confidence that the peculiarity was real as sky conditions at the time of his observations were *most satisfactory*. However, in his second and final observing report on the comet [1882a] he noted that his observations near the time of perihelion had been hampered by moonlight, haze and the low altitude of the comet. No other astronomer appears to have noted the peculiarity reported by Plummer, and it was most likely an artefact of the poor sky conditions. Appendix 4 provides more details.

4. *Projection on the limb* during lunar occultations

Nineteenth century astronomers reported the phenomenon *of projection on the limb* (or *hanging on the limb*, or *attached to the limb*) when a star about to be occulted by the Moon appeared to hang (or be projected upon) the lunar limb for a few seconds before disappearing. Occasionally astronomers reported the analogous phenomenon at a reappearance event.

Plummer [1869c] reported an observation of the occultation disappearance of Gamma Tauri on 28 March 1868 (mentioned above). He described the star as being *attached to the lunar limb* for five seconds before disappearance. This was his only reported observation of *projection*.

In his textbook [1873a], completed in 1872, he provided four pieces of evidence to prove that the Moon *is destitute of any sensible atmosphere*. His evidence included the observation of occultations, during which he stated that the star disappears with *astonishing suddenness* behind the limb of the Moon. He made no mention of reports of projection.

In 1873, he published a paper [1873c] describing the phenomenon of projection, reviewing the main explanations already put forward to explain it, and offering a new explanation of his own. His explanation was based upon a supposed lunar atmosphere, most dense around the limb, which refracted the light of the star just prior to it being occulted. Plummer tested his theory by examining reported cases of maximum

projection in the literature in the preceding 20 years; for each such case he evaluated the lunar libration at the point of projection on the lunar limb. Not surprisingly this line of analysis was totally inconclusive. He made no attempt to reconcile the explanation in his paper with the description given in his textbook.

R A Proctor then engaged in correspondence with Plummer in the pages of MNRAS [1873d, 1873e, 1873f] about the cause of projection. In his final contribution on the subject, Plummer [1873e] appeared to indicate that the supposed lunar atmosphere responsible for projection was in fact the Earth's atmosphere extending tenuously to the distance of the Moon. However, his text on this point was far from unambiguous and he provided no further explanation of this hypothesis. Appendix 5.3 provides more details.

5. Problems with the Orwell Park transit instrument

Plummer made literally thousands of transit measurements with the Orwell Park transit instrument but appeared to experience considerable difficulties in so doing.

In 1878 he reported [1878c, 1878d] a cyclic variation in the errors of the transit instrument. The amplitude of the errors was circa 10" in both azimuth and altitude. Such a large error must have presented considerable operational difficulties. He concluded that the cause of periodic variability in the errors was heat radiated from the pier supporting the equatorial refractor. But this conclusion was based on evidence that was tenuous and circumstantial at best. Alternative explanations were equally plausible. For example, changes in climatic conditions might have affected moisture levels in the ground around the foundations of the Observatory, making it hard in summer months and spongy in winter months, causing a change to the angle and depth at which the Observatory settled. However Plummer made no mention even of considering alternative explanations. He also appeared to be unaware of the meeting of the Royal Institution of British Architects on 16 November 1874 at which Wilfrid Airy, design engineer for the Observatory, described how the transit telescope was supported by large wrought-iron beams which could expand and contract due to variations in temperature, altering the alignment of the transit instrument.

He used the transit instrument to estimate the longitude of the Observatory and published [1879b] a final estimate 30".25 east of the accepted value (the Ordnance Survey has adopted the current value of the longitude of Orwell Park Observatory, namely 1° 13' 58" East, since at least 1838[3]). It is likely that this discrepancy is due in part to the large errors associated with the transit instrument.

In Plummer's [1882b] annual report to the RAS for 1881, he appeared to conclude that the transit instrument was unsuitable for demanding astronomical work. Unfortunately, Plummer did not enlarge on the reasons for his conclusion. Appendix 11 provides more details.

[3] Established by OASI member Paul Whiting with reference to an 1838 Ordinance Survey map of the region.

6. Work to determine the accuracy of star catalogues

In 1876 Plummer [1876b] gave an initial report on a major piece of work that he had commenced to investigate the accuracy of positional data in the BAC star catalogue. Unfortunately, the paper was not up to his usual standard of clarity, and failed to articulate clearly the approach that he adopted. In the paper he noted that he had evidence that proper motions had varied during the previous century or so: *Again, I do not know that we have any right to assume that proper motion is in all cases constant both in direction and amount during the long interval of 120 years which has elapsed since Bradley's observations, and indeed I believe that I have already discovered some evidence to the contrary*. Frustratingly, he did not reveal evidence of the supposed variation in proper motions and there is no indication in the literature that he followed up the matter!

His next reference [1877b] to work to investigate the accuracy of star catalogues was in his annual report to the RAS for 1876: in this he reported investigating the proper motions of 2028 stars and noted that data reduction was proceeding.

His final reference to the accuracy of star catalogues was in his annual report to the RAS for 1878 [1879b] where he stated that he anticipated obtaining *interesting results bearing on proper motion*.

Unfortunately, although Plummer undertook a lot of work, both theoretical and observational, investigating the accuracy of star catalogues, he did not appear to publish any definite results of his labours. Appendix 10 provides more details.

7. Miscellaneous proposals lacking credibility

Two of Plummer's proposals which particularly lacked credibility were as follows:

- He reported [1874d] observations of *repeated brilliant exhibitions of the zodiacal light* in the months leading up to November 1874. He expressed the belief that the zodiacal light was subject to a previously unreported annual variability, but did not appear to follow up this speculation with any further observations. Appendix 9 provides more details.
- His proposal [1876c] for a new nomenclature for stars and planetoids, although logical, was inevitably doomed to failure and was not adopted by other astronomers. It is doubtful that Plummer expected his proposals to be taken seriously! Appendix 15.1 provides more details.

--- To be continued ---