Reflections

Journal of the Northern Sydney Astronomical Society Inc.

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That's it, a new year and a new decade are upon us!
But this issue of Reflections is rather turned towards the past with pictures of our Christmas party.
Then, an article from Peter Nosworthy remind us of the last appearance of Halley's comet in 1986.
Paul Shallow takes us quite a bit further back with a tentative explanation for the Star of Bethlehem.
And finally, as for myself, I undertook to pen a history of the first attempts to measure the solar system, which takes us way back to the ancient Greeks.

However, in this 1st month of the new year, let's look to the future and allow me to wish you all the best for 2011 and lots of starry nights.
Cheerio,

Jean-Luc Gaubicher

In this issue

President's Message

Welcome to a New Year, both on the calendar and for the Society. Hopefully everyone has had a nice Christmas and New Year break, and you are looking forward to some interesting astronomy in 20ll.

As I'm sure most of you know, I was persuaded to run for President for another year and, probably by default, you've got me for another 12 months (from October). We've had a few changes on the Committee and I'd like to introduce Peter Nosworthy, a relatively new member who has stepped up to take on the role of Vice-President. He's already had to deputize for me while I was overseas in November. Please introduce yourself at the next opportunity, if you haven't already. I'd like to thank Bob Roeth, who has stepped down from the VP job this year, for his support last year. Bob remains a Committee Member Without Portfolio.

Looking at the Society membership, at a current number of about 70 persons, we continue to remain in a balance between new members and members not renewing. The Committee has made it a priority this year to increase our membership to a more sustainable level and any ideas from the membership to promote this would be appreciated. On that subject, Committee Meetings are usually held before the Theory Group on the 2nd Tuesday of each month (at 7:00 PM). Any member is welcome to attend and add to the discussion. Otherwise, if you have any ideas or suggestions, just send them to the nsas@nsas.org.au_email address, and they will be taken up by the Committee.

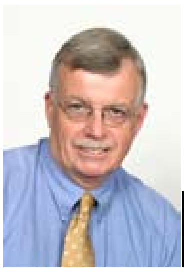
Since the last Reflections the Society has had a relatively quiet period. Observing has remained dismal in the second half of 2010 due to the current La Nina weather cycle, the last good Observing Night was in August! The Society had a good turnout at the Macquarie Open Night in October, which we supported with three scopes and a strong presence in the main hall with our new banners.

Because of the problems with observing at North Turramurra (due to weather) and our inability to run any dark sky nights at Mt. White the second half of 2010, an initiative has been launched to come up with an alternative dark sky observing program. Discussions have started with WSAAG (Western Sydney Amateur Astronomy Group), who have access to Linden Observatory, to make it possible for NSAS observers to attend their Observing Nights, which are generally one or two Saturdays each month. I expect to have this sorted out by the time this Reflections is published.

The Suggestions section of the Membership Renewal for 2011 has resulted in some interesting ideas from the membership, which will be followed up by the Committee. One idea that seems to be very popular is to have some field trips in 2011, possibly to astronomical sites such as the AAO and Parkes, and possibly also to include some observing in the country. We'll definitely be working on some ideas to put to the membership.
The New Astronomers Group, after a year or so of strong activity, has become less well attended of recent months and there seems to be a general opinion that we give it a rest for a while. That being said, I intend to try and get a number of the new members (and even older members who have become interested in observing) to see if there is enough interest to start the original NAG concept again with a new group of people. Even though observing has been pretty dismal during 2010, I think those who started the original NAG group have "graduated" to fully "qualified" observer status and will be active once the weather become favorable.

That being said, Summer is often one of the best times of the year for observing, even though with Summer Time we have to start a lot later in the evening. There's lots of interesting objects in the sky this time of the year so, when Observing is on, come out and renew your interest in the sky.

I will have retired from regular work by the time of this edition, so you can expect me to be more active, and around a lot more in 2011, so I look forward to seeing you at Society activities..



Best Regards,

Bob Fuller

Calendar

General Meetings:	February 15th	Guest Speaker: Stefan Oslowski from UNSW will talk about quasars.
	March 15st	Guest Speaker: TBA
Theory Group Meetings:	February 8th	
	March 8th	
NAG Meetings:	TBA	
Observing Nights:	Consult NSAS' web site at http://nsas.org.au/observing/	
Deadline:	Please send your contributions to the April issue of Reflections in time to reach the editor **before March 15th** to nsas.editor@ozemail.com.au	

The Star of Bethlehem

Now when Jesus was born in Bethlehem of Judea in the days of Herod, the king, behold there came Wise Men from the East to Jerusalem, saying,
"Where is he that is born king of the Jews? For we have seen his star in the East and are come to worship him."
Then Herod, when he had privily called the Wise Men, inquired of them what time the star appeared. And he sent them to Bethlehem and said:
"Go and search diligently for the young child; and when ye have found him, bring me word again that I may come and worship him also."
When they had heard the king, they departed, and lo, the star, which they saw in the East, went before them 'til it came and stood over where the young child was. When they saw the star, they rejoiced with exceeding great joy.

Although there were three gifts: gold, frankincense and myrrh, we do not know that there were three Wise Men. And although we often show the Wise Men wearing crowns, we do not know that they were really kings.
Often we show a brilliant star streaming light into a manger with the Christ child surrounded by the Wise Men. Yet it is possible that the Wise Men reached Bethlehem months after the birth of Jesus and that the object they followed was not a brilliant star.

Perhaps the Wise Men were astrologers or mystics using the motions of heavenly bodies to predict events on Earth.

In 45 BC Julius Caesar visited Egypt and adopted its solar calendar, complete with leap days every four years. He decided to set the winter solstice as December 25th and to begin the new year on January 1st. This Julian calendar was used throughout the Roman Empire at the time of Christ's birth. Julius Caesar's choice of December 25th as the winter solstice is probably the reason Christ's birth is celebrated on that date today.

In the sixth century, the monk Dionysius tried to reset the calendar of Julius Caesar to begin with Christ's birth. He set the date of Christ's birth as December 25th of the year he called 1 BC. He began the Christian era on January 1, 1 AD. - just six days later - to agree with the start of the Roman year. The letters AD are from the Latin "anno domini" meaning "in the year of our lord". However, Dionysius did not know that a zero year is needed between 1 BC and 1 AD. The concept of zero did not exist in European mathematics at the time of Dionysius. He also miscalculated the dates of Augustus Caesar's reign by about 4 years. With this uncertainty, we need more information to determine the exact year of Christ's birth.

According to Matthew, Christ was born when Herod was on the throne in Jerusalem.
The Jewish historian, Josephus, reported that Herod died before the feast of Passover that followed an eclipse of the Moon. Such an eclipse occurred on the morning of March 13th, 4 BC. Most of Jerusalem would have been asleep for several hours when the dark part of the Earth's shadow first touched the Moon at 1:45 AM.
Within a few minutes the bite out of the Moon's disk became obvious. At 2:53 AM the eclipse reached its maximum with 35 percent of the Moon hidden from the sleeping city.

King Herod probably died in late March or early April of 4 BC – between the March 13th eclipse and the beginning of Passover on April 10th

Biblical scholars think that Christ was born 2 to 3 years before Herod's death, making the spring of 7 or 6 BC most likely for Christ's birth.

Perhaps the Star of Bethlehem was really a wandering planet. In the first century AD, astronomers thought that planets were perfect spheres circling the Earth.

If the Star of Bethlehem were really a planet or grouping of planets, it would

have occurred in one or more of these constellations – probably in a pattern associated with Judea.
Recently Dr. Michael Molnar, an astronomer and coin collector, studied ancient Roman coins minted in the first century AD in Antioch, Syria. These coins show Aries, the ram, looking at a star over its shoulder. According to the Roman astrologer, Marcus Manilius, Aries was the constellation representing Syria, including Judea.
A rare celestial event in Aries could have indicated the birth of a king in Judea.

Ancient astronomers knew exactly where the Sun was in the star field, even though they could never see the Sun and the stars at the same time. In mid-May of 7 BC, facing south, the Sun was in Taurus and the crescent Moon was in Aquarius. Jupiter, the royal planet, and Saturn were close together in Pisces.

Venus-Jupiter Conjunction 18/06/02BC

As we move from 7 to 6 BC, the Moon will race around the Earth once every month while the Sun drifts eastward through the Zodiac band.
In late May, the brighter Jupiter passed Saturn with both planets moving eastward. As the Earth moved between these planets and the Sun, the Wise Men could have seen both planets slow down, stop, and reverse directions.
Once again the faster moving Jupiter passed Saturn at the end of September with both planets now moving westward. Finally Jupiter passed Saturn for the third time in one year with both planets moving eastward in early December.
This is called a Triple Conjunction – a rare event that could have attracted the attention of the Wise Men. If the Wise Men were watching, they would have seen Mars join Jupiter and Saturn for a planet massing in February 6 BC.

Then the Sun entered Pisces and moved past the planets, hiding them from direct view. The bright planet Venus followed the Sun into Pisces.
Our story continues in mid-April with the Sun and the constellation Aries on the horizon at dawn. For the best view, we must also face east.
Once the Sun reached Aries, the planets became visible in the eastern predawn sky, rising before the Sun. If the Wise Men faced East at dawn on April 13th, 6 BC, they would have seen Jupiter, Saturn, Venus, and the crescent Moon above the rising Sun. By April 15th, the Moon had passed Venus and was close to Saturn. It had become a very slender crescent as it approached the Sun.
At this time, the Sun, Jupiter and the Moon were in Aries.
On April 17th, the dark Moon covered Jupiter just before Sunrise. At dawn, the royal Jupiter reappeared, conquering both the Moon and Sun as it climbed upward from the Eastern horizon with both Saturn and Venus in view.
For an astrologer, this would have been a powerful harbinger of a king's birth in the lands associated with Aries, including Judea.

Perhaps the Wise Men decided to search for this child and set out across the desert after the heat of summer. When they reached Jerusalem, they were told to turn south to Bethlehem. In the southern sky, they found Jupiter in Aries once again.

On December 19, 6 BC, Jupiter stopped its backward motion and stood still in Aries – hanging below the waxing gibbous Moon.
The Wise Men could have observed that the royal planet Jupiter "stood over" the horizon and led them south to Bethlehem and to the Christ child.

Venus-Jupiter Conjunction 05/08/06BC

No scientific explanation can fully explain the vision of the Wise Men. But this interpretation fits the astrology practiced at the time and the words of St. Matthew. However, if we accept the literal Biblical interpretation that the Wise Men actually saw and followed a visible star, then we can come to only one conclusion: their observation is not an astronomical object, but a miracle.

Every year, tourists journey to the Holy Land to celebrate Christmas but, to see the sky over Bethlehem 2,000 years ago, just go outside – to a place far from modern city lights. There you will find the Moon, Aries and Orion, with the three stars of his belt pointing to the brilliant Sirius.

The stars of that first Christmas are still with us today and the December Sun still follows its lowest path of the year over the deserts of Judea, just as it has for all of recorded history

Traditions based on the stars of Christmas will be special as long as you and your family celebrate the holidays under the starry night.

Paul Shallow

Comet Halley, 25 years on

2011 marks 25 years since Comet Halley made its last visit. In 1986 I observed and photographed Halley, and wrote a journal to record the event. This account is based on that journal and my memories of that time.

Getting Time Off

My boss was somewhat puzzled when I submitted two leave-request forms, each for one week and spaced three weeks apart. I had to explain that I needed time off only during the dark of the moon, to observe the comet. He tried to persuade me to take two weeks in a block but I stood firm. My next chance to see Halley would be in 2061, and I didn't want to miss it.

Finding a Site

I had spotted Halley from my house at Lane Cove in late 1985 using binoculars and my 4-inch telescope but I really needed a dark site. I knew that the Astronomical Society of New South Wales had an observatory at Bowen Mountain near Richmond so I reasoned that it must be a good dark sky area.

I drove up there in daylight to scout out a site where I could set up my scope. After some searching, I eventually found a small park - perhaps a vacant block of land - in a lightly populated area up on the mountain. There was a large concrete block not far from the road - possibly a sewer cover - that was big enough to provide a solid base for my scope.

My 4 inch Schmidt-Cassegrain scope (yellow tube) with a cheap 60 mm refractor mounted alongside for guiding.

Worst Viewing for 2000 Years

Despite the media hype that raised the public's expectations unrealistically, the 1986 appearance of Halley was the worst for the past 2000 years. At closest approach to the Sun in February, the comet and Earth were on opposite sides of the Sun, making observing impossible.

The comet emerged from behind the Sun in March as a dim fuzzy blob. Fortunately, the southern hemisphere was the best vantage point, prompting many enthusiastic northerners to make the trip south. Taking the Moon phase into account, the best viewing times were in mid March and early April.

Observing - March 19th 1986

In March, Halley was visible only in the morning before sunrise, requiring me to rearrange my schedule, observing at night and sleeping during the day.

I left home at around midnight on March 18th and the drive up to Richmond took about an hour. When I arrived at the site, it was dark - really dark. I was using a red torch and it was so dark that I couldn't even find the path leading into the park! I had to remove the red filter from my torch before I could find it. I quickly located the concrete block and, looking up at the sky, I noticed that the stars looked fuzzy. There was a misty layer of cloud that I had not noticed earlier and it was ruining the view!

This presented a dilemma. Should I set up my equipment in the hope that the mist would clear, or try to find another site at short notice? I decided on the latter, although with some trepidation. It had taken considerable effort to search out a suitable site in daylight. It would be much more difficult in the dark with very limited time.

I drove back down the mountain and stopped the car to take a quick look at the sky. Sure enough, the stars were now sharp dots. The mist must have been clinging to the mountain and not affecting the surrounds.

I continued driving along Bowen Mountain Road, and then Grose Vale Road - a lightly populated area - looking for a suitable spot by the side of the road. I eventually found a flat level area big enough to park my car safely off the road and set up my scope.

There was a house on the other side of the road about thirty metres from my position, but there were no lights visible.

I began setting up my equipment. I was using a 4-inch Schmidt-Cassegrain scope on a German equatorial mount. For this session I would piggyback my camera and photograph with the camera lens while using the main scope for guiding.

Unexpected Visitors

A couple of cars went past while I was setting up but there were fewer as it got later. Each time a car approached I would turn away from the headlights and close my eyes to preserve my night vision. It was a little scary being on a remote country road in the small hours of the morning. Every time a car went past I worried that they might stop and mug me.

Then, while I was still trying to polar align the mount, a car approached. I turned away, shielding my eyes as usual and did not see it as it went past. But moments later my fears were heightened when I heard the car slowing and then stopping about thirty metres beyond my position. With a feeling of foreboding I turned to look and saw that it was a police car!

This was both good news and bad news. At least they probably wouldn't mug me. But I worried that they were going to tell me to move. Perhaps I was breaching the little-known 'Setting of Optical Equipment on a Public Road' law!

The car reversed back towards me, stopping just a few metres away. Two uniformed police got out and walked over. "Are you looking at Haylee's Comet?" one asked. Rather than correct his pronunciation, I just said "yes."

"Can we have a look?" the other one asked.

Although I was still in the middle of doing the polar alignment, I quickly slewed the scope by hand over to the comet and inserted a low power eyepiece for them to take a look. They were fascinated and, after I had answered a few of their questions, they wished me luck and left.

The Comet

It was nearly 3am before Halley was high enough to start photographing. I made only three exposures of the Comet that night. One was interrupted when I had to cover the lens due to the headlights of a passing car. Another 30-minute exposure was ruined when the lens became fogged with dew. The remaining 5-minute exposure was okay.

I wrote in my journal:

"The appearance of Halley after it climbed out of the glare was not at all spectacular. Although the tail could be vaguely seen, the comet was not conspicuous except when using averted vision with the naked eye. Averted vision showed a tail of about three degrees. The view through the telescope at medium power (40x) was less impressive than that obtained with binoculars or even the naked eye with averted vision. No structure was observed in the tail."

Memories of 1910

My mother's friend May was in her late eighties. It occurred to me that she might be old enough to remember the 1910 appearance of Halley, which was much more spectacular that the current one.

May had lived in England as a child. She said that she did indeed remember the comet. Her description of it was simply "a big bright thing in the sky." Despite this, I wondered if she was really remembering

Halley. There was another bright comet in 1910 - the Great Daylight Comet - which is often mistaken for Halley by those alive at the time. It was so bright that it was visible in daylight, as the name would imply. Nevertheless, it was fascinating to have this link to the previous visit of the most famous comet.

Comet Halley, March 20th 1986. The thin straight plasma tail can be seen extending upward and to the right (the one-o'clock position), while the dust tail is wider and goes straight upwards.
Technical detail: 30 minutes, f4.5, 200mm lens, ISO 400 colour film

Observing - March 20th 1986

There had been a technical problem at the photo lab and they had been unable to make last night's prints in time for me to look at them before the second night's session. However, I had seen the negatives, and the results looked encouraging despite the problems with dew and car headlights.

I again left home just after midnight, arriving at the site at about 1.15am. I went to the same spot as the night before - by the side of the road - rather than trying the mountain again. I didn't want to waste time going up the mountain only to be thwarted by mist again.

Observing The Comet

On this night I used my piggybacked SLR camera with a 200 mm lens and was able to make five images of Halley. One of these - a 20-minute exposure - turned out to be my best picture of the comet.

I wrote in my journal:

"The comet appeared less prominent than it had the night before and the naked eye view using averted vision showed a tail of less than one degree in length. The reason for this could not be determined as the rest of the sky appeared just as dark as the night before but, of course, this was purely a subjective judgement."

The Dog

At about 2am, a dog began barking loudly nearby. It seemed to be coming from the house a short distance along on the far side of the road. I guessed that the animal was barking at me. It continued for a long time and I became concerned that the house owner might come out to investigate and ask me to leave.

After half an hour, the errant beast was still barking. A light came on in the house and shortly thereafter, the barking stopped. I speculated that the canine had been executed. This theory was disproved when the barking resumed about an hour later. Fortunately it only lasted a couple of minutes this time, and the animal was silent for the rest of the night.

The Two Dollar Comet

I packed up my equipment and departed shortly before the start of twilight. As I was passing the Richmond R.A.A.F. base I noticed a large handwritten sign on the side of the road which said "COMET HERE $2." A little further along I saw a large white telescope tube.

I stopped and was greeted by a young man - perhaps in his thirties - with an American accent who was offering views of Halley through his 12-inch Newtonian. I told him that I was returning from photographing the comet and we chatted for a few minutes about astronomical matters.

Halley was by now quite high, so I had to climb a stepladder to reach the eyepiece of his scope. At 40x magnification, it appeared brighter than it had in my 4-inch scope, but there was no additional detail visible. When I offered to pay him, he said that there would be no charge for me because I was a fellow amateur astronomer. I thanked him and continued on my way.

A Second Comet Appears?

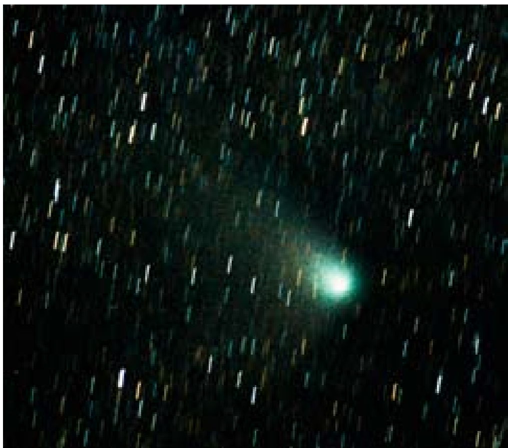
In early April, when Halley was high in the southern sky and the moon was favorable, I again ventured out to observe. For reasons I don't recall, I wrote very little in my journal about these observing sessions and thus much of the detail has been forgotten. The Comet was by now quite different in appearance from just three weeks earlier. The tail was now pointing away from Earth and looked more like a fan-shaped halo than a tail.

Around April 12th, members of the public began calling radio stations and newspapers, reporting that there were now two comets in the sky! The explanation was simple. Halley was now high in the southern sky with almost no visible tail, and was only a few degrees from the globular cluster Omega Centauri. With both objects appearing as fuzzy blobs in binoculars, they looked remarkably similar. People turning their binoculars to that area for the first time were seeing both Halley and the great globular cluster, mistaking it for a second comet.

Towards 2061

On nights when I didn't travel to a dark observing site, I would set up my scope in my front yard at Lane Cove. One night, my next-door neighbours - a young couple - came over to have a look. Halley had received a lot of media coverage, and yet most people had not been able to see it. My neighbours were therefore eager to see Halley with their own eyes.

After they had both looked through my scope, I suggested that they bring their five year-old son out and let him look at the comet. They were reluctant. It was a cold night and the boy was already asleep. I told them that among all of us, only the boy would likely live to see Halley on its next visit. His grandchildren might then ask him if he remembered seeing Halley in 1986.



Comet Halley, April 9th 1986. By guiding on the comet, its motion against the background stars is apparent even in this short exposure.
Technical detail: 52minutes, f4.5, 200 mm lens, ISO 1600 colour film

The couple woke their son and brought him outside where he looked through my telescope at Comet Halley.

Perhaps in 2061, an eighty year-old man will remember that night.

Peter Nosworthy

All pictures by the author

Measuring the Solar System

Measuring distances in the solar system has been a problem that has always bothered mankind.

The earliest recorded attempts were made by the ancient Greeks.

First, we have to dismiss a widespread myth that would make us believe that it was common belief, until the Renaissance, that the Earth was flat.

Indeed the ancient Greeks already knew that it was a sphere. They have deduced this fact from several observations:

- They had observed that when a ship was nearing the coast the sails and masts were the first to appear over the horizon.
- They knew that a lunar eclipse was caused by the transit of the Moon through the Earth's shadow and, as they always saw this shadow circular, they reasoned that Earth itself must be round.
- They also had reports from Phoenician navigators who described the emergence of new stars as they travelled North or South.

Depending on the sources, the stories of Eratosthenes and Aristarchus can vary widely but these are the most accepted versions.

Eratosthenes, who at that time was the chief librarian of the library of Alexandria, knew that in the city of Syene (modern Aswan) the Sun, on the Summer solstice, would cast no shadow and would actually shine down to the bottom of a well. He had also measured the angle of the shadow in Alexandria on the same day and had found it to be 7°12'.

Knowing the distance from Alexandria to Syene and that Syene was roughly due South of Alexandria he calculated the Earth's circumference to be 252,000 stadia (Fig1).

Figure 1

Assuming he used the Egyptian stadion of about 157.5 m his estimation turns out to be 39,690 km.

Actually, his calculation is erroneous for several reasons: Alexandria and Syene are not exactly on the same meridian, Syene is slightly North of the tropic and the distance between Alexandria and Syene he used is very approximate. But all these errors balance and his result his astonishingly

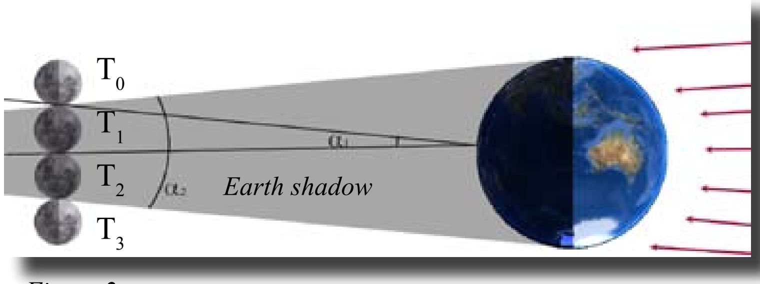


Figure 2

T_0 - The Moon enters Earth's shadow

T_1 - Totality

T_2 - End of totality

T_3 - The Moon emerges from the shadow

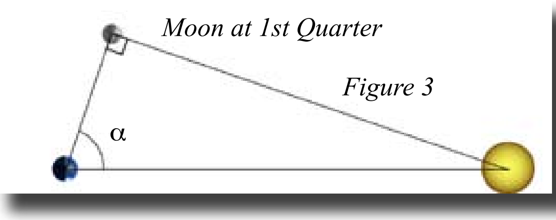
$\alpha_1 \sim \alpha_2$

accurate (1% error.)

It seems that Aristarchus of Samos was the first to try and calculate the distances to the Moon and to the Sun around 250 BCE.

He argued that if the Sun was at a great distance the angle formed by Earth's shadow is about the same as the angular size of the Sun as seen from Earth.

Measuring the duration of a lunar eclipse (Fig 2) he deducted that the diameter of



the Moon was approximately 3/8 of the Earth's and knowing the angular size of the Moon, there was only one distance to put the Moon: he evaluated this distance to be 60 times the Earth's radius or approximately 382,000 km. The Moon's orbit being elliptical, its distance to Earth actually varies from 364,000 km to 406,000 km but, once again, this is a pretty good result.

To estimate the distance to the Sun, Aristarchus made use a triangulation method devised by Thales of Miletus around 600 BCE to work out the distance of a ship at sea from 2 onshore observations.

To do it, he used the fact that, when the Moon is at first or last quarter, the triangle formed but Earth, the Moon and the Sun is a right-angled triangle (Fig 3). Estimating the angle α to be 87°, he calculated the Sun to be 19 times further away than the Moon, that is to say 7 million 261 thousand kilometres.

This time, sadly, his estimation was far from accurate: Earth orbits the Sun at an average distance of 150 million kilometres.

Aristarchus' reasoning was perfectly valid but he was let down by the lack of proper instruments: measuring α without any instrument is very difficult and it is in actual fact approximately 89.85°.

Around 1530, Copernicus used the same method to estimate the distance of Venus: when Venus is at quadrature, α has a value of 43°. He deduced that the Sun-Venus distance was 0.68 times the distance Sun-Earth or 0.68 Astronomical Unit.

In fact, it is in average 0.723 AU.

Kepler's third law allows us to calculate all distances in the solar system once we know one of them: for all planets orbiting a same star the ratio a^3/T^2, where a is half the long axis and T is the period, is constant.

Figure 3 shows what happens if the orbits of two planets P_1 and P_2 were circular: we would have $a_1^3/T_1^2 = a_2^3/T_2^2$ and $D = a_1 - a_2$, which gives $a_2 = a_1 * t_2^{2/3} / t_1^{2/3}$.

The fact that the orbits are elliptical makes the calculations a bit more complex but this method was fully understood at the beginning of the 17th century and the relative distances of the planets well known. The precise measure of the Astronomical Unit was all that was missing to have the solar system finally mapped!

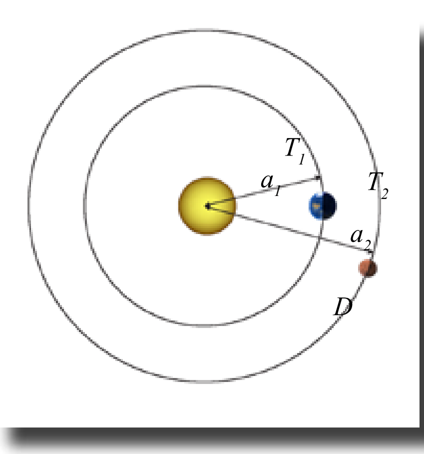


Figure 4

In 1716, Edmond Halley proposed a method based on the geometric principles of parallax and the use of the transit of Venus to estimate the distance from the Earth to the Sun.

This method involved the determination of the shift in the and the precise timing of the 4 different contacts.

This was attempted in 1761 and 1769, after Halley's death in 1742, when numerous expeditions, including the famed Captain Cook's one, were organized.

All in all, 76 observations of Venus' 1769 transit where made but the "black drop effect" made it hard to say when the transit began and ended. Still, the resulting estimate of 153 million km is just 2% out of the currently accepted value of 149.6 million km.

It is not until the use of photography in 1874 and 1882 that astronomers managed to get an even more precise estimate.

From there, the solar system was mapped with a precision that was largely adequate for the needs of both astronomy and space exploration.

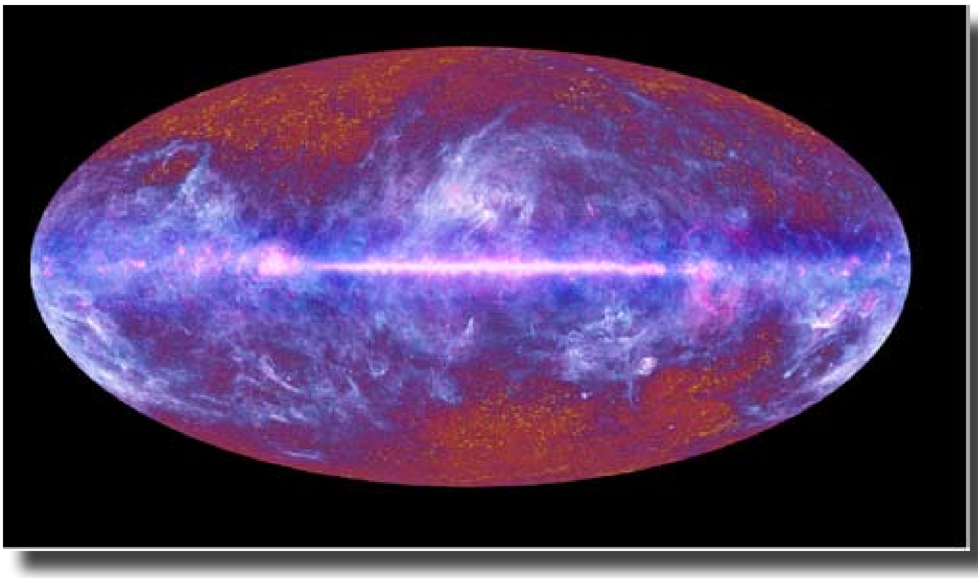
Of course, nowadays, technology allows us to reach precision that even early 20th century astronomers could not have dreamt of: thanks to the retro-reflectors left on the Moon's surface by the Lunokhod and Apollo missions the lunar distance is known with a 1cm precision; and radar beams can be used to measure the distances of the Sun and the planets with similar astonishing precisions.

Jean-Luc Gaubicher

All drawings by the author
Please note that they are not to scale.

The Microwave Sky as seen by Planck

ESA PR-15 2010 ESA's Planck mission has delivered its first all-sky image. It has been composed using data from Planck covering the electromagnetic spectrum from 30 GHz to 857 GHz and it not only provides new insight into the way stars and galaxies form but also tells us how the Universe itself came to life after the Big Bang.



The Planck One-Year All-Sky Survey
Image Credit: ESA, HFI & LFI Consortia

"This is the moment that Planck was conceived for," says ESA Director of Science and Robotic Exploration, David Southwood. "We're not giving the answer. We are opening the door to an Eldorado where scientists can seek the nuggets that will lead to deeper understanding of how our Universe came to be and how it works now. The image itself and its remarkable quality is a tribute to the engineers who built and have operated Planck. Now the scientific harvest must begin."

While the Milky Way shows us what the local Universe looks like now, those microwaves show us what the Universe looked like close to its time of creation, before there were stars or galaxies. Here we come to the heart of Planck's mission to decode what happened in that primordial Universe from the pattern of the mottled backdrop.

The microwave pattern is the cosmic blueprint from which today's clusters and superclusters of galaxies were built. The different colours represent minute differences in the temperature and density of matter across the sky. Somehow these small irregularities evolved into denser regions that became the galaxies of today.

The mottled structure of the CMBR, with its tiny temperature fluctuations reflecting the primordial density variations from which today's cosmic structure originated, is clearly visible in the high-latitude regions of the map. The central band is the plane of our Galaxy. A large portion of the image is dominated by the diffuse emission from its gas and dust. The image was derived from data collected by Planck during its first all-sky survey and comes from observations taken between August 2009 and June 2010. This image is a low- resolution version of the full data set.

To the right of the main image, below the plane of the Galaxy, is a large cloud of gas in our Galaxy. The obvious arc of light surrounding it is Barnard's Loop – the expanding bubble of an exploded star. Planck has seen whole other galaxies. The great spiral galaxy in Andromeda, 2.2 million light-years from Earth, appears as a sliver of microwave light, released by the coldest dust in its giant body. Other, more distant, galaxies with supermassive black holes appear as single points of microwaves dotting the image.

Planck continues to map the Universe. By the end of its mission in 2011, it will have completed four all-sky scans. The first full data release of the CMBR is planned for 2012. Before then, the catalogue containing individual objects in our Galaxy and whole distant galaxies will be released in January 2011.

"This image is just a glimpse of what Planck will ultimately see," says Jan Tauber, ESA's Planck Project Scientist.

ESA Press Release

Xmas Party, Sausage Sizzle
...and Lunar Eclipse

This year, our Christmas Party was held as a combined event with our annual sausage sizzle and, as usual, it was pretty well attended.
Clear skies allowed us to marvel at the final stage of a magnificant lumar eclipse.
To top it all, Bob Marsh gave us a guided tour of St Ignatius' observatory and seismometre.
A really succesful night, thanks to all who gave their time and effort to organize it.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Picture Credit:
(1) Yuko Nosworthy,
(2) Peter Nosworthy
(3) Jean-luc Gaubicher

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PO Box 56 Lane Cove 1595 Tel: 0423 971 374 E-mail: nsas@nsas.org.au Web site: www.nsas.org.au