Reflections

Journal of the Northern Sydney Astronomical Society Inc.

Volume 20 Number 3 **October 2009**

Another issue of your Society's magazine. An with it comes the end of a very eventful and satisfying year.
But, as you will read in the President's Message, new blood is needed to fill in various committee positions.
No experience needed, just enthusiasm!
Do not hesitate to come forward and put your hand up; the future of YOUR society is at stake.
With this in mind, I hope to see you all at our Annual General Meeting, Tuesday October 20, usual place, usual time.

In this issue Bob Fuller takes us to India. While names such as Chandrasekhar or Subramaniam are well known it is quite eye-opening to learn that India has a long and proud history in the field of astronomy that dates back to the 1500s.
You will also find the last installment in Arthur Boyd's series of articles as well as other shorter ones that you may find of interest.
By the by and once again, I'd love to get articles from you: as the deadline for the January issue is December 15, you still have 2 months to send me your lucubrations...

Cheerio,

Jean-Luc Gaubicher

In this issue

President's Message

It is now October, and the end of the Society's year.

We will shortly be having the Annual General Meeting, and I encourage every member to attend. The Society is suffering from lack of member interest this year (at least on the part of the members from before 2009), and whether the Society continues in its present form will be very much up to the members.

We've continued to attract and induct new members into the Society since the last edition of Reflections, and they have already been enthusiastic in both participation, and in supporting the business of the Society. Our roster of new members has increased by 9 since last reported; John Knight, Roslyn Scouller, Max Dias, Ekhardt Gross, Gary Maas, Geoff Unsworth, Tara Djokic, Colin Fenning, and Jane Thompson. Vincent Miu has resigned, and as David Adermann has been un-contactable and un-financial, he has been struck off.
I'd particularly like to thank all of those new members who have made up a good chunk of the volunteers who have participated with their scopes at the various outreach activities in the last three months, and those who have assisted the Committee in such matters as Observing and the Website.

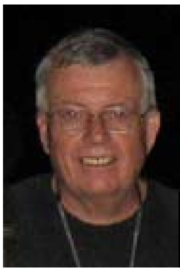
The Society has been extremely active in this period, participating in the Barker College Star Party, as well as Science Week lectures, supported St. Ignatius College with telescopes in their Science Week, and with Willoughby Council, participated in the second Star Party of the year for their Spring Festival.
One of the issues I've tried to bring up recently is whether the Society is over-stretching its resources by being so active in outreach, and there are some signs that we are reaching "outreach fatigue".

Observing has continued, as best we could with variable weather, and the New Astronomers Group has been very active, meeting twice a month up until recently. I think it's safe to say that a lot of the New Astronomers have earned their stripes, and can now observe fruitfully. While the NAG will continue to educate, particularly the newer members, it may split into two streams, one for further interest like the old Telescope Users Group, and one for new observers.

Based on the above, the Society looks like it is running smoothly and fulfilling its charter, but the problem is that too few persons are doing far too much of the administration and activities.
And that will have to change if we are to continue as an active club. Paraphrasing what JFK said, "ask not what your Society can do for you, but what you can do for your Society". I'd really like to see some new faces in the Committee, and try to fill some of the empty or inactive positions in the Society's structure with the AGM elections in October.

Think about what you would like to see the Society do, and how you can help out, as a lot of the current Committee will retire, leaving many open positions.

Best regards,



Bob Fuller

Calendar

General Meetings:
- **October 20th** — **Annual General Meeting** Guest Speaker: TBA
- November 17th — Guest Speaker: TBA
- **December 15th** — **Christmas Party**

NAG Meetings:
- October 27th
- November 24th

Observation Nights:
- October 16th / October 23rd
- November 13th / November 20th
- December 11th / December 18th

Deadline: Please send your contributions to the January issue of Reflections in time to reach the editor **before December 15th**

Most distant supernovae found

With its wide-field MegaCam CCD camera, CFHT (Canada France Hawaii Telescope) took the last images for the CFHT Legacy Survey (CFHTLS) in January of this year.
This Canadian-French project spread over 500 nights and nearly 6 years. Even though the full analysis of its images for the main goals of the survey is still work in progress, the CFHTLS has already provided amazing discoveries form our solar system to the remote universe.

The SNLS (SuperNovae Legacy Survey), one of the components of the CFHTLS, observed four areas of the sky each the size of the MegaCam field (one square degree) to detect the explosion of SuperNoave (SNe). Each of the "deep" fields has been monitored every few nights around new moon for half a year over each year of the duration of the survey. An amazing number of SNe were discovered by comparing each new block of observation (generally worth one hour of exposure time) with a reference image taken earlier.

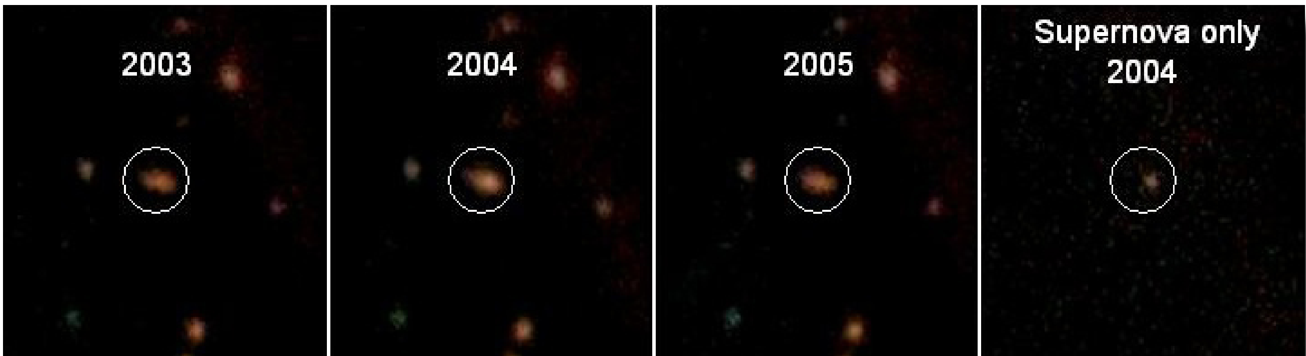
An international team of astronomers, led by Jeff Cooke (University of California, Irvine), used the images of the SNLS in a different way: all images taken on a given field on the same semester were stacked together.
The stacks, going now very deep as they corresponded to tens of hours of exposure time, were compared to each other from semester to semester.

While the method does not allow to follow the explosion itself, with the raising of the light up to to the maximum of its explosion and the slow decay over the following weeks, it allows to discover very distant SNe, too faint to be seen in one hour of exposure time, as illustrated on the series of pictures below.
These images show the host galaxy containing one of the newly discovered supernovae.
Comparing the images shows how the galaxy visibly brightens in 2004 and then returns to normal. This suggested that in 2003 the supernova was not detected; it appeared in 2004 and had mostly faded in 2005. The last frame subtracts the images from the years that the supernova was not detected as well as the galaxy's light to reveal only the supernova.
Cooke then used a Keck telescope to look more closely at the spectrum of light each object emitted and confirmed they were indeed supernovae.

Two of the four newly SNe discovered happened about 11 billion years ago, 2 billion years earlier than the previous record holder, which happened nine billion years ago.

Source: CFHTLS

Image Credit: Jeff Cooke/CFHT



Did you know?

716 rotations per second.
That's the rotational speed of the fastest pulsar ever observed.
Similar to all neutron stars, its radius is less than 15 km, which means that the radial velocity at its equator is more than 67,500 km/s! One quarter of the speed of light.

Back to Basics

You may have asked yourself, or may have been asked this simple question: why is the sky blue?
And maybe the answer has been eluding you. So here is a short explanation to that phenomenon.

It all has to do with the way sunlight interacts with the molecules of Earth's atmosphere.
As you know, the white light from the Sun is a mixture of all colours of the spectrum. Each colour has a specific wavelength and the visible part of the spectrum ranges from red light (wavelength =720 nm) to violet (wavelength =380 nm), with all the colours of the rainbow in between.
When light passes trough a clear medium such as the atmosphere its molecules, mostly nitrogen and oxygen in the case of air, and the particles in suspension intercept and scatter it.
In the19th century Tyndall and then Rayleigh thought that the blue colour of the sky must be due to small particles of dust and droplets of water vapour in the sky. But they were wrong!
Gustav Rye studied this phenomenon more rigorously in 1908 but it's Einstein who did the math in 1911.

The Tyndall effect is due to the scattering of light by particles in suspension in a fluid (gas or liquid). This effect is very common under a forest canopy or under clouds. It's also the reason why you can see the beam of your laser pointer at night.
But it has nothing to do with the colour of the sky.

The Rayleigh scattering, or resonant scattering is due to scattering ,of light, or any other electromagnetic radiation for that matter, by particles that are much smaller than the wavelength of the radiation. In our case, it is light's interaction with the air molecules that is responsible for the blue colour of the sky.
The amount of Rayleigh scattering varies as the sixth power of the particle size and varies inversely with the fourth power of the wavelength, which means that the shorter wavelength of blue light will scatter more than the longer wavelengths of green and red light. Coming to us from all angles in the sky, this blue light makes the sky appear blue.

This is also why the sun looks yellow (yellow equals red plus green or white minus blue).

At sunset, the sky changes colour because as the sun drops, sunlight has more atmosphere to pass through and loses more of its blue wavelengths. The orange and red, having the longer wavelengths, are less scattered and are therefore predominant when light reaches us.

Jean-Luc Gaubicher

Tyndall effects:
Left: Sunrays in a forest
(Image credit: Wikipedia)
Under: Laser beam through a glass of diluted milk
(Photo by the author)

Rayleigh scattering in the atmosphere after sunset, picture taken over the ocean, at 500m altitude.
(Image credit: Wikipedia)

Juno on show

Toward the end of September, the sun will turn a spotlight on the asteroid Juno, giving that bulky lump of rock a rare featured cameo in the night sky. Those who get out to a dark, unpolluted sky will be able to spot the asteroid's silvery glint near the planet Uranus with a pair of binoculars.

"It can usually be seen by a good amateur telescope, but the guy on the street doesn't usually get a chance to observe it," said Don Yeomans, manager of NASA's Near Earth Object Program Office at JPL. "This is going to be as bright as it gets until 2018."

Juno, one of the first asteroids discovered, is thought to be the parent of many of the meteorites that rain on Earth. The asteroid is composed mostly of hardy silicate rock, which is tough enough that fragments broken off by collisions can often survive a trip through Earth's atmosphere.

Though pockmarked by bang-ups with other asteroids, Juno is large; in fact, it is the tenth largest asteroid. It measures about 234 kilometers (145 miles) in diameter, or about one-fifteenth the diameter of the moon.

The asteroid, which orbits the sun on a track between Mars and Jupiter, will be at its brightest on Sept. 21, when it is zooming around the sun at about 22 kilometers per second (49,000 miles per hour). At that time, its apparent magnitude will be 7.6, which is about two-and- a-half times brighter than normal. The extra brightness will come from its position in a direct line with the sun and its proximity to Earth. (The asteroid will still be about 180 million kilometers [112 million miles] away, so there is no danger it will fall towards Earth.)

Skywatchers with telescopes can probably see Juno from now until the end of the year, but it is most visible to binoculars in late September. On or before Sept. 21, look for Juno near midnight a few degrees east of the brighter glow of Uranus and in the constellation Pisces. It will look like a gray dot in the sky, and each night at the end of September, it will appear slightly more southwest of its location the night before. By Sept. 25, it will be closer to the constellation Aquarius and best seen before midnight.
See ephemerides on page 8

Source: http://neo.jpl.nasa.gov/
As relayed by Paul Shallow

The Foundation of Scientific Astronomy in India

During the time of the Mughal Empire of India, whose Persian emperors ruled in the northern plains of India around Delhi, Agra, and Jaipur from the 1500's to the mid 19th century, there was a great blossoming of science.

The first observatory that Jai Singh built, in Delhi, while not having as many instruments, and not being as sophisticated, is nonetheless an impressive site. The brickwork is brilliant red, and this contrasts with the marble used for the instrumentation.

The height of the Mughal influence was around the turn of the 17th and 18th centuries, and while this period had a number of emperors, most supported the arts and sciences.

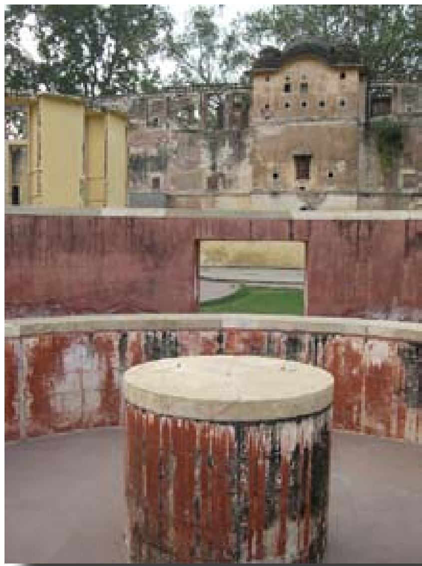
Maharaja Sawai Jai Singh II was born in 1686 at Amber, near Jaipur, and when he became king of Amber on his father's death in 1699, he consolidated the Mughal rule in his area, and attracted the attention of the Mughal emperor.

Eventually he became governor of the provinces around Agra and Jaipur in 1719. Jai Singh was not only an able commander and administrator but excelled in subjects like science, astronomy, mathematics and town planning. He founded his capital, Jaipur, in 1727 and studied the Hindu, Muslim, and European systems of observation and calculation relating to astronomy. He brought European experts into India and developed brass instruments for calculating astronomical values. Of course, the main reason at this time for studying astronomy, and particularly for astronomical calculations, was that of astrology, which had long been practiced in India.

Jai Singh became unhappy with the results he was getting with his brass instruments, and started developing the idea of astronomical instruments built of bricks, mortar and clay. One of his emissaries to Europe returned with a copy of La Hire's Tables, and Jai Singh then worked out how to build structures that incorporated these astronomical tables. The emperor Muhammad Shah then ordered Jai Singh to build the Delhi observatory using these designs and this was completed in1724. Ten years later, he built a similar observatory at Jaipur and later at Ujjain, Varanasi, and Mathura. All of them still exist with the exception of Mathura's that was destroyed in the 1800's.

The two observatories that have been restored to their original standards are the ones in Delhi and Jaipur. They were destroyed to some degree in the 1800's but they have been restored to full operational standard.

Both are called "Jantar Mantar", which means "instrument for calculation". They have similar instruments but the Jaipur observatory, having been built later, has 15 astronomical instrument complexes and one unfinished, 6 of which function as solar instruments and 11 as Lunar and Stellar instruments. They give a precise measure of time, of the declination of the Sun, the azimuth of the Sun, the location of constellations and other information.



The Azimuth Instrument consists of a central structure and two outer rings, all topped with marble, and graduated with degrees. The purpose was to measure the azimuth of the Sun.

The Hindu theory of astronomy in practice at the time of the Mughal observatories was fairly similar to that of Europe at the time. The earth was believed to be a sphere set in a hollow celestial sphere, on which inner surface the stars were situated. The celestial sphere rotates once a day.

The planets are in orbits around the Earth and constellations, which have the same declination wherever observed (as was believed), proved that the stars were at a great distance.

The Hindu astronomical measurements were not degrees, minutes, and seconds, but the following:

60 Ghatis	= 1 day & night	= 24 hours
60 Palas	= one Ghati	= 24 minutes
6 Prana	= one Pala	= 24 seconds

However, Jai Singh used the European method of measurements (degrees, minutes, and seconds) in his observatories and the astronomical circle is divided into 60 Ghatis of 6 degrees each.

The Armillary Sphere Instrument consists of two concave hemispherical marble bowls which represent the celestial hemispheres turned upside down. There are complex markings, including Zodiacal symbols, and the rim in marked in degrees. A ring hangs in the middle which is representative of the Sun.

Sidereal time is used, the time being zero when the vernal equinox is rising on the eastern horizon. The Hindu sidereal day thus begins six hours earlier than the modern sidereal day.

A look at the instruments in the Jaipur observatory will show how Jai Singh used his tables to build an observatory of brick instruments.

The scientific curiosity of Jai Singh led to the development of what are now two of the best preserved early observatories in the world, and also show the very sophisticated level of science at the height of the Mughal empire in India.

Bob Fuller

Further information can be found simply by Googling "Jantar Mantar".
Sources:
• Wikipedia
• Astronomical observatory of Jaipur, Mittal Publications, New Delhi;
• Delhi's Jantar Mantar, Shalini Publications, New Delhi
Images: Author's from visit to the observatories

The Ram Yantra is a multifloor version of an Azimuth Instrument which also measures the altitude of heavenly bodies. At sunrise the shadow falls on the central pillar at what is essentially zero altitude.

The Periodic Cycle Instrument, through the use of gnomons placed at various locations, can tell midday in a number of locations around the world, including Zurich and Greewich, both of which had observatories at the time this one was built.

The Equinoctial Instrument is a vertical hole in the wall of one of the instruments. The lower surface is inclined at the latitude of Delhi (28 degrees 39 seconds) so that when the Sun enters into the chamber and falls on a peg only when it is in the equinoctial position (exactly above the equator), twice a year.

The Hemispherical Sun Dial measured the local time at the latitude of Jaipur. There is one for Summer and one for Winter. A gnomon is fixed in the dial to mark out the time.

The Great Astrolabe is one of the largest astrolabes in the world. It is 3 meters tall and weighs 400 kg. It is a celestial map, engraved on a seven-alloy metal disk. The hole in the middle is the Pole Star.

Macquarie Lighthouse at South Head - Sydney

In 1791, a signal flagstaff was erected at South head and it became the main navigational aid for Sydney Harbour. Coordinates 33°51’00”S, 151°17’00”E.

In the early 1800s messages were relayed from the Signal Station flagstaff to Observatory Hill then to Kissing Point, Putney, over to Dundas and on to Government House, Parramatta.

The Royal Navy Code of Flag Signals was added to the Colonial Signals to transmit messages. Eventually, in 1858, an electric telegraph took over from the flags. A road to the Signal Station was built in 1811.

The first lighthouse was built in 1818 by a convict, the Colonial Architect Francis Greenway. The Governor, Lachlan Macquarie, was so pleased with the result that he emancipated Greenway. After deterioration of the stonework, in 1880, a new lighthouse was commissioned and designed by the then Colonial Architect, James Barnet. It was essentially a copy of the original, except for a larger lantern and additional apparatus, provided by Chance Brothers of Birmingham. The headland is 105 metres above sea level and the tower is 26 metres high. Electricity was not connected until 1933 and it was fully automated in 1976.

In August 1857, the Dunbar was wrecked on the rocks below the Signal Station with a loss of 121 lives.

Arthur Boyd

Acknowledgements:
Wikipedia
The Australian Volunteer Coast Guard Association
Sydney Port Corporation
Photographs by Charles Kerry Studio,
Tyrrell Collection, Powerhouse Museum,
Sydney

Become a Galactic Zoologist

Do you want to take part in an international astronomical research?

The goal is to classify the 1/4 million galaxy pictures taken by a camera attached to the Sloan Digital Sky Survey.
To become a Galactic Zoologist, just register at galaxyzoo.org.

You will be presented with pictures of galaxies and, for each of them, asked a few simple questions. Your answers will then become part of a database used for numerous projects.
For more information and to register go to www.galaxyzoo.org.

Example of questions you will be asked

Barker College Galileo Star Party

After some months of planning, NSAS supported Barker College's Star Party on Wednesday the 12th of August.

Run as a part of Barker's Science Week activities, the Star Party took place on a sports ground with an adjacent lecture hall.
A number of other activities, such as face painting, a 400th birthday cake for Galileo and information on astronomy, took place near to where we set up our 7 scopes.

The evening was a bit spotty, with some early clouds and overcast about 9 pm, but in general most of the 200+ crowd of students and parents got a look through a scope at such interesting objects as Jupiter, the Jewel Box and Omega Centauri.

Geoff Unsworth's 16" Lightbridge attracted a long queue, of course. Ron Washington lectured on various astronomy and space-related matters to good audiences and the feedback from Barker was very positive.

Later in the week, as a part of the Science Week program, I lectured to three 8 to 10-year classes on the History of the Telescope (IYA presentation) and a primer on different types of telescopes and how they work.
The 8-year class was the most interested, engaging me in a lot of hard questions ranging from astrophysics to theology!

Once again, Barker was most appreciative, and the planning and execution of our outreach program was a good model for future activities.

Bob Fuller

St. Ignatius Astronomy Night

St. Ignatius Astronomy Night took place on August 19th.

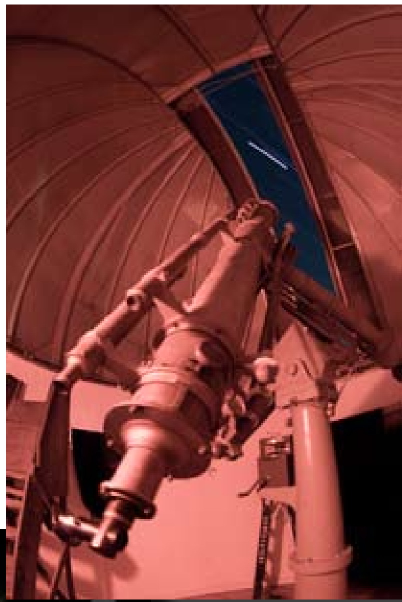
Following a lecture by Fred Watson students and science teachers came out in drove to see with their very own eyes what Fred had been talking about.

Though a bit overcast early on, the sky did clear up in time but heavy light pollution from nearby buildings prevented the observation of any nebulae or galaxies.

We therefore had to content ourselves with views of Jupiter, clusters and double stars.

Jean-Luc Gaubicher

Pictures by www.pearsephotography.com.au



Crux Word Solution

by Bob Roeth

	J	A	N	U	S				O		I			S			
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N			C	R	O	W	N			E	S	A		E		A	
V			H		N		T					A	U	R	O	R	A
E			R	A	D	I	A	T	I	O	N			E			
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Juno Ephemerides

Source: http://neo.jpl.nasa.gov/horizons

Date	Hr.min	R.A.	DEC	APmag
2009-Oct-10	00:00	23 47 21.01	-07 44 34.5	7.96
2009-Oct-11	00:00	23 46 48.66	-07 55 14.7	7.98
2009-Oct-12	00:00	23 46 17.43	-08 05 40.7	8.00
2009-Oct-13	00:00	23 45 47.39	-08 15 51.8	8.02
2009-Oct-14	00:00	23 45 18.57	-08 25 47.6	8.04
2009-Oct-15	00:00	23 44 51.05	-08 35 27.7	8.05
2009-Oct-16	00:00	23 44 24.88	-08 44 51.5	8.07
2009-Oct-17	00:00	23 44 00.10	-08 53 58.8	8.09
2009-Oct-18	00:00	23 43 36.76	-09 02 49.0	8.11
2009-Oct-19	00:00	23 43 14.92	-09 11 21.9	8.13
2009-Oct-20	00:00	23 42 54.60	-09 19 37.3	8.15
2009-Oct-21	00:00	23 42 35.86	-09 27 34.8	8.17

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