

february 2006



monthly newsletter of the johannesburg centre of assa

Old Republic Observatory, 18a Gill Street, Observatory, Johannesburg
PO Box 412 323, Craighall, 2024



2006 was delayed by a leap second – more on page 12

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notice of next meeting – assa johannesburg

The next monthly meeting of the Johannesburg Centre of the Astronomical Society of Southern Africa will be held at the old Republic Observatory, 18a Gill Street, Observatory, Johannesburg on Wednesday 8 February 2006 at 20h00.

**Most starlight that we see is generated in nuclear reactions within stars.
To find out about nuclear reactions on earth we have a talk by**

Dr Eben Mulder

Pebble Bed Modular Reactor (PBMR): Part of the energy mix in South Africa.

assa johannesburg committee members & volunteers for 2005/2006

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	Evan Dembskey	evan@dembskey.org	

ATM: Amateur Telescope Making classes held on the premises of Parktown Boys High School on most Saturday afternoons.

ASSA Johannesburg Centre's mailing-list subscriptions:

Announcements and discussion, send a *blank* email to: assajhb-subscribe@yahogroups.com

ATM class' mailing list, send a *blank* email to: assaatm-subscribe@yahogroups.com

Canopus Digital, send an email with your *name* (and membership no.) to: gross@gmail.com

nasa plans to remove foam from shuttle

edited article by Warren E. Leary

A section of insulating foam that unexpectedly broke loose when the space shuttle Discovery lifted off in July will be removed from future fuel tanks to eliminate the hazard. William H. Gerstenmaier, the agency's director of space operations, said a large section of foam that shielded pipes and cables on the side of the shuttle's large external fuel tank would probably not be used again.

Engineers have long assumed that the area, known as the PAL ramp, needs the insulating foam to protect the equipment. But since the shuttle was designed in the 1970's, the pressurized fuel lines, fixtures and a cable box protected by the ramp have been strengthened. Now, wind-tunnel tests and computer models indicate that the foam is not necessary in that area.

During the launching of the Discovery, the first in the more than two years since the Columbia disaster, NASA engineers were surprised and disturbed when a one-pound chunk of foam broke free from this ramp area despite years of efforts to eliminate or reduce foam shedding. Last month, engineers found tiny cracks in the foam insulation of another fuel tank that had been filled with the shuttle's supercold liquid hydrogen and liquid oxygen propellants that may be related to foam coming loose during launchings.

During the Discovery's flight, pieces of foam broke loose from four other areas of the redesigned tank, but Mr. Gerstenmaier said those losses had been attributed to causes other than the cracks and had been addressed with other solutions.

He said the next shuttle flight could still take off next May, as NASA has tentatively planned, even with the fuel tank modifications. Officials had said previously that removing the foam ramp could push the flight to the end of 2006, but Mr. Gerstenmaier said a re-examination of old test data and new computer modelling suggested that such a long delay would be unnecessary.

He said the Discovery's flight last summer to the International Space Station provided valuable data for future flights by letting NASA assess the many changes made to the shuttle and its operation since the Columbia accident.

Even if there are further delays before the next flight, he said, NASA can still reach its goal of flying the shuttle 18 more times to complete the space station and also mount a repair mission to the Hubble Space Telescope.

"We don't need to have a flight this spring to make the 19 flights," Mr. Gerstenmaier said.

editorial

Robert Groess

2006 is now well and truly underway. And the plate is full of astronomical delights to feast upon in the months to come. Our largest event of the year, ScopeX, will be held on Saturday, 6 May and promises to be a great attractor as it has been in the past. Canopus will bring you up-to-date news regarding the society's activities as they are finalized.

The subscription list for Canopus DIGIAL continues to grow and I encourage all of you who do not yet use this new and exciting medium, to give it a try. All you need to do is send me an email telling me you'd like to be put on the Canopus DIGITAL mailing list, and your full colour PDF edition of Canopus will arrive near the end of the month for the following month.

Your trusty team of regulars is back in full force in this edition, so I need not say much more, except perhaps, enjoy!

Until next month...

The Editor.

NB! ScopeX 2006!

Our annual telescope and astronomy expo is getting closer.

Diarise the date, tell your friends, finish that telescope to show off, go out there and take that winning image!

Let us know if you want to help or exhibit on the day.



6 May 2006 : 10am to 9pm
Military History Museum

Lead Sponsor: SAASTA
(South African Agency for Science and Technology Advancement)

More info at...
www.assajhb.co.za
Mailto: lerika@ai.con.co.za



chairman's chat

Brian Fraser

We have an interesting line-up of speakers for the first half of the year, so thanks to Lerika (and others) for organizing this. With the dearth of professional astronomers in the Johannesburg area we don't have access to cutting-edge research and have to rely on members and contacts at the local universities for our speakers. I am sure our members won't be disappointed this year.

SAASTA, our landlords at the observatory, have indicated that they will be starting with some upgrades to the site very soon. It may be that we are not able to use the usual lecture hall for all of our meetings but keep an eye out for any change of venue.

Alec Jamieson (and better half), Atze Herder, Dave Hughes and a team of helpers have now sorted out the library and housed it in a new room kindly provided by SAASTA. It is immediately behind the 26-inch dome, slightly up the hill and is accessed by a little road just past the 26-inch dome. They will have the library open from about 6pm on the nights of the monthly meetings. Pop in and see what is available.

Tentative plans are in place for a couple of special events this year. Biggest and most important is Scopex on 6th May, so all the ATM'ers have a couple of months to get their fantastic telescopes finished. Then we plan to have a quarterly star party at the War Museum (Jhb. zoo) with the first one on March 25th. We are also going to arrange a Sunday morning visit to the Transvaal museum in Pretoria to see their meteorite collection and have a talk on the topic. Also pencilled in is a guided visit to the Vredefort dome area, probably to Parys, at a time when the rains have stopped and it is a little cooler.

We are taking a group to Turkey to see the solar eclipse on March 29th. Turkey is a truly fascinating country and if you would like to join the group you might just squeeze in if you reply TODAY.

And in-between all this we hope to do some astronomy. Be prepared – you are going to be encouraged to do some REAL astronomy. Gird your loins.

Brian

general announcements

- | | |
|-------------------|---|
| Library: | The new library will be open before the monthly meeting. |
| Star Party: | At the War Museum behind the Jhb. zoo on March 25th 2006. Bring friends and the whole family and a telescope if you have one. There will be a short talk on interesting items in the sky to look for. |
| Monthly Meetings: | We will have a short talk on "whats up" in the sky, before the main talk. |

encarni's reflections

Encarni Romero Colmenero – erc@sao.ac.za

Belated Happy New Year!

It has now been two months since I last sent in a contribution to Canopus, mainly due to a lot of year-end tasks that prevented me from submitting on time, so I thought I ought to give you an update on how things are at SALT.

After the inauguration ceremony, I discovered that a lot of people think SALT is now finished and we are now just doing 'proper' science observations, which is not exactly true. Let me explain. We are indeed already making some scientific observations for all the partner institutions (including, of course, South Africa!) and there are a few exciting scientific publications based on SALT data that are about to appear in various scientific journals. We also now have the full compliment of SALT astronomers (6 of us in total), so our observing shifts are now a week out of every 6 weeks instead of every 3 weeks, which is a lot nicer!

The observing team, led by Kiwi/South African David Buckley, is now made up of a Spaniard (me), a Fin (Petri Väisänen), Russian (Alexei Kniazev), two Brits (Martin Still and Nicola Loaring) and a Japanese astronomer (Yas Hashimoto) coming from different institutions around the world, such as the UK, Chile, Germany and USA.

The telescope, however, is still undergoing commissioning. A lot of the valuable observing time is still required for various "engineering" or commissioning tests, so we are not quite yet in the full swing of science only. While both SALTICAM and the imaging spectrograph, RSS (formerly known as PFIS) are working well, there are still some modes of operation of both instruments that are still in the process of being fully tested, such as drift-scanning (in case you haven't heard about it before, drift-scanning is a technique whereby we 'park' the telescope and tracker at a particular position and continuously readout the CCD at the same rate at which the stars are moving in the sky, thus effectively creating a long image of a long strip in the sky), multi-object spectroscopy, polarimetry or Fabry-Perot imaging.

We are also still testing the reliability of some telescope components, such as the edge-sensors (which will keep the 91 segments that make up the primary mirror perfectly aligned throughout the night during all weather conditions) and the autoguider for the imaging spectrograph; we are testing and improving our pointing models, tackling a long-term problem with image quality and about to install some extra components, such as an atmospheric dispersion compensator and an autoguider for SALTICAM.

We are also busy developing and testing both 'proper' and 'quick-look' data-reduction software so that we can easily gauge the quality of the data we just obtained at the telescope, and the SALT proposal preparation and submission tool, also known as the PIPT.

As you can see, we are going through a very busy but also extremely exciting time at SALT. Things are certainly looking up and scientific observations are certainly happening nearly every night. Many things still remain to be finalised, and life at the telescope promises to be very interesting for a few months to come yet!

Until next time,
Encarni

armchair astronomy

K. G. Stewart

Word search with a theme. The solution will be provided next month. Prize for getting it right: absolutely nothing! Clue: 40 names. Good luck!

CONSTELLATIONS

C	O	R	O	N	A	B	O	R	E	A	L	I	S	A
A	H	L	E	O	P	H	I	U	C	H	U	S	V	D
N	T	A	U	R	U	S	P	E	G	A	S	U	S	E
E	X	J	M	M	S	A	P	R	E	C	N	A	C	M
S	E	I	R	A	V	H	U	J	S	N	A	T	C	O
V	I	R	G	O	E	S	S	C	U	L	P	T	O	R
E	E	A	Q	U	I	L	A	S	N	A	L	O	V	D
N	S	L	S	E	R	P	E	N	S	S	I	P	T	N
A	Q	U	A	R	I	U	S	O	U	U	B	X	H	A
T	K	P	T	M	M	L	S	N	N	Z	R	U	Y	T
I	S	U	P	E	L	E	I	U	O	C	A	R	D	T
C	Q	S	A	R	A	C	N	J	D	A	E	C	R	I
I	L	A	C	E	R	T	A	S	G	N	S	T	A	G
C	A	S	S	I	O	P	E	I	A	G	I	R	U	A
P	I	S	C	I	S	A	U	S	T	R	I	N	U	S

Albert Jones – discoverer of SN1987A

by Lyn Rens

I've just come back from New Zealand where I was lucky enough to contact amateur astronomer Albert Jones, discoverer of Supernova 1987A, who lives not only in the same town as my hosts, but in the same suburb! In chatting, he mentioned the late, much missed, Danie Overbeek, as well as Jan Hers, to whom he sends his regards.

Albert Jones is a dedicated variable star observer, and at the age of 85 still works every night without fail on the stars in his programme, which is not easy when the sun sets after 10 pm in summer in New Zealand. He uses a 12.5 inch f5 telescope which he built to his own design in 1948 (yes, nearly 60 years ago). It is on a fork mounting made from a large industrial pulley wheel with two arms welded on.

The night he discovered the Supernova, the brightest extra-galactic supernova in history, he had been at a hiking club committee meeting. It was high summer, 24 February (1987 of course) with corresponding late sunset, and he didn't stay for the socialising afterwards as it was getting dark and he had to get to his variables. He went home and started his observations, then noticed clouds coming over so decided to check quickly on some stars in the Large Magellanic Cloud before they were obscured, and found an unexpected bright blue star. His initial thought was that he had pointed the telescope incorrectly, but no – the 3 stars he wanted were definitely there, and so was the intruder. The clouds intervened before he could make a magnitude estimate, and he phoned Frank Bateson, director of the Variable Star section of the RAS of NZ.

He went back to his telescope and the clouds cleared so he was able to make his magnitude observation and again phoned Frank Bateson who then phoned Siding Springs Observatory in Australia. They of course immediately stopped their observations to check the Supernova, and phoned Brian Marsden of the Central Bureau for Astronomical Telegrams in the USA. Albert kept observing the Supernova and other variables until 1 a.m., had a short nap, then resumed observing until dawn.

Albert Jones has also discovered 2 comets – the first in August 1946 and the second in 2000. He holds the record for the greatest interval between comet discoveries, as well as being the oldest observer to discover one. He has had a minor planet named after him, and when he gave a talk “Six Decades of Visual Photometry” in July 2002 at a workshop in Brussels, and another offer of a minor planet name was made, he asked that it be named after his wife, Carolyn who has been very supportive of his astronomy. However, there was already a minor planet of that name so they compromised and named Minor Planet 9171 Carlyndiane, using her first two names.

It was a great honour to be able to talk with him.

mission to mars via antarctica

edited ESA News Release – 21 December 2005

Italian and French researchers are about to spend a full year in one of the most inhospitable places on Earth: Antarctica. But it's paradise compared to what astronauts would face if they stepped out on the surface of Mars. As part of its Aurora Exploration Programme, ESA is considering a human mission to Mars by 2030. One stage of this exploration program is the Concordia station in Antarctica, which simulates many of the conditions and constraints that astronauts would face living on Mars.

A few weeks before leaving for the Antarctic Concordia Station, the Italian-French crew that will spend over one year in one of the harshest, isolated environments on Earth, attended two days of preparatory training at ESA's Headquarters in Paris, France. During their stay at the research station the crew will participate in a number of ESA experiments – the outcome of which will help prepare for long-term missions to Mars.

As part of the Aurora Exploration Programme, ESA is considering participating in a human mission to Mars by the year 2030. Research projects are planned or are already underway to develop the technology and knowledge needed. By being involved in programmes that have requirements similar to those of a mission to Mars, ESA will gain experience on how best to prepare for such a challenging mission.

"The Concordia Station is an ideal location as it replicates certain aspects of a Mars mission," explains Oliver Angerer, ESA's coordinator for the Concordia research programme. "The crew lives in an extreme environment in one of the most remote places on Earth. During the winter the base is completely cut off with no visitors and no chance for rescue. In such an isolated location, the crew has to learn to be fully self-sufficient."

Built and operated jointly by the French Polar Institute (IPEV) and the Italian Antarctic Programme (PNRA), the Concordia Station was completed in 2004. A letter of intent was signed with IPEV and PNRA in 2002 that enabled ESA to cooperate on some aspects of the project.

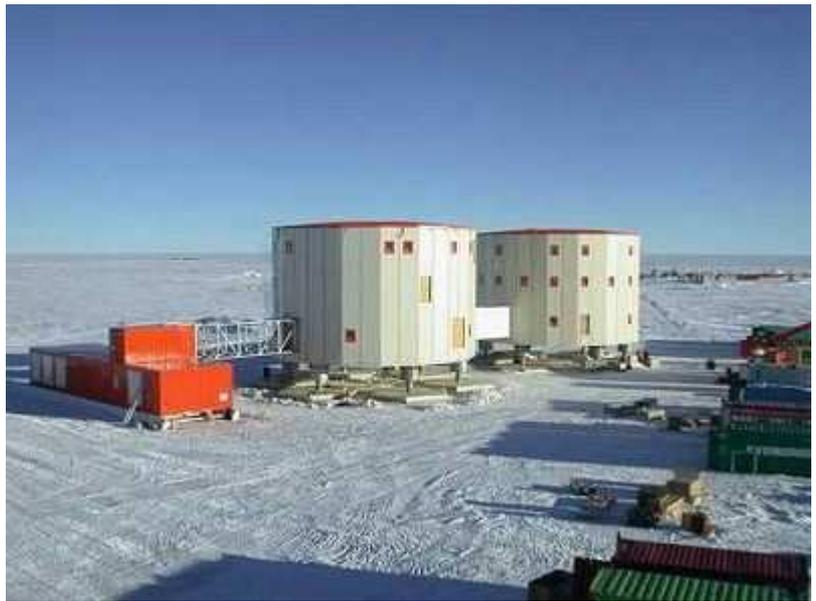
Capable of providing home to up to 16 crewmembers in the winter, the station consists of three buildings, which are interlinked by enclosed walkways. Two large cylindrical three-storey buildings provide the station's main living and working quarters, whilst the third building houses technical equipment, like the electrical power plant and boiler room.

Last November, the first crew finished their winter-over which was dedicated to the technical qualification of the station . The summer season sees a swelling in the number of inhabitants as short-stay scientists take advantage of the less extreme weather (however, mean air temperature is about -30°C during this time!).

Three scientists who are part of the next Concordia winter-over crew have already made the long journey to Antarctica. The rest of the crew, who will leave for the Antarctic research station during December, gathered at ESA's Headquarters in Paris for two days of pre-departure training. They received briefings about life at Concordia, including aspects such as safety and the implications of the Antarctic Treaty for activities at the station.

The seven crewmembers also heard about research at the station, including two special experiments for which they will act as subjects during their stay. In 2003, ESA coordinated together with the Concordia partners a Research Announcement for medical and psychological research, from which six proposals were selected.

The two experiments, which are the first to be implemented in the coming season, look at psychological adaptation to the environment and the process of developing group identity; issues that will also be important factors for humans travelling to Mars. For this research the crew will complete questionnaires at regular intervals throughout their stay.



ESA's Mistacoba experiment, which already started a year ago when the first crew started living at the station, will also continue after the crew rotation. Starting from a newly built clean environment, samples are taken from fixed locations in the base as well as from crewmembers themselves. The Mistacoba experiment will provide a profile of how microbes spread and evolve in the station - an isolated and confined environment - over time.

To protect the Antarctic environment, all waste materials must be removed from the Continent. For the Concordia Station, this means that all waste materials have to be appropriately treated. Regarding water, based on ESA life support technologies, ESA developed, together with PNRA and IPEV, a system to recycle the so-called 'grey water' collected from showers, laundry and dishwashing, which has been operating for a year in line with the requirements of the Concordia partners.

In mid-February the last plane of summer visitors will depart from Concordia leaving the crew to their own devices. "For those nine winter months the crew will experience extreme isolation," adds Oliver Angerer. "Concordia is a real operational environment, something we would never be able to simulate in a laboratory. This will enhance and complement our research and give us valuable insight we need to prepare for Mars."

library update

by Alec Jamieson

The library opened its doors to members from 6 to 8 pm before the November and January monthly meetings, and attendance was encouraging on both occasions. This arrangement will continue.

Switchgear and power cables to the Sir Herbert Baker library building were stolen. The library security alarm cannot function without power, so a snappy decision was made to move the library to a more secure location. Thanks are due to SAASTA for their prompt response to our predicament. Thanks are also due to Dave Hughes for providing a trailer and some men to help move the library contents from A to B. Librarians usually know how many books they have in their libraries, but this librarian also has a good idea of how many kilograms of books he has in his library!

The library is now located in a room adjacent to the parking area behind the 26" telescope building. The room is bigger than the room we had previously, and it is more convenient for access from the monthly meeting venue.

Non-astronomical books have been grouped separately from books on astronomy. In due course the astronomy books will be classified under headings drawn from the Dewey Decimal Classification System (DDCS). So far, most interest has been in books on telescope making. Books on telescope making will find a place with telescope equipment in the DDCS. Classifying the books in this way will facilitate browsing.

Many Sky & Telescope and other magazines have been sorted into date order and the ASSA Jhb centre has one of the better collections of Sky and Telescope going back to the 1940's. Surplus copies have been identified and are available for sale at R5 per copy. Contact Atze Herder at awherder@wol.co.za

The library team looks forward to seeing new faces at the library in future.

Alec Jamieson



2006 delayed by a second

edited article from a NASA News Release

Did you notice the minute with 61 seconds? The start of 2006 was delayed by the first "leap second" in seven years, a timing tweak meant to make up for changes in the Earth's rotation.

The adjustment was carried out by sticking an extra second into atomic clocks worldwide at the stroke of midnight, 1 January 2006, Coordinated Universal Time (UTC).

In South Africa, the extra second occurred just before 2 a.m. on New Year's day. Atomic clocks at that moment read 23:59:60 (UTC) before rolling over to all zeros.

A leap second is added to keep uniform timekeeping within 0.9 seconds of the Earth's rotational time, which can speed up or slow down because of many factors, including ocean tides and tsunamis. The first leap second was added on June 30, 1972, according to NIST, an arm of the U.S. Commerce Department.

High-speed communications systems among other modern technologies require precise time measurements. Since 1999 until recently, the two time standards have been in close enough synch to escape any need to add a leap second.

Although it is possible to have a negative leap second – that is, a second deducted from Coordinated Universal Time – so far all have been add-ons, reflecting the Earth's general slowing trend due to tidal braking.

Deciding when to introduce a leap second is the responsibility of the International Earth Rotation and Reference Systems Service, a standards-setting body. Under an international pact, the preference for leap seconds is December 31 or June 30.



books & media

Available to buy:

Skymap Planisphere

Reference Latitude: 35° South

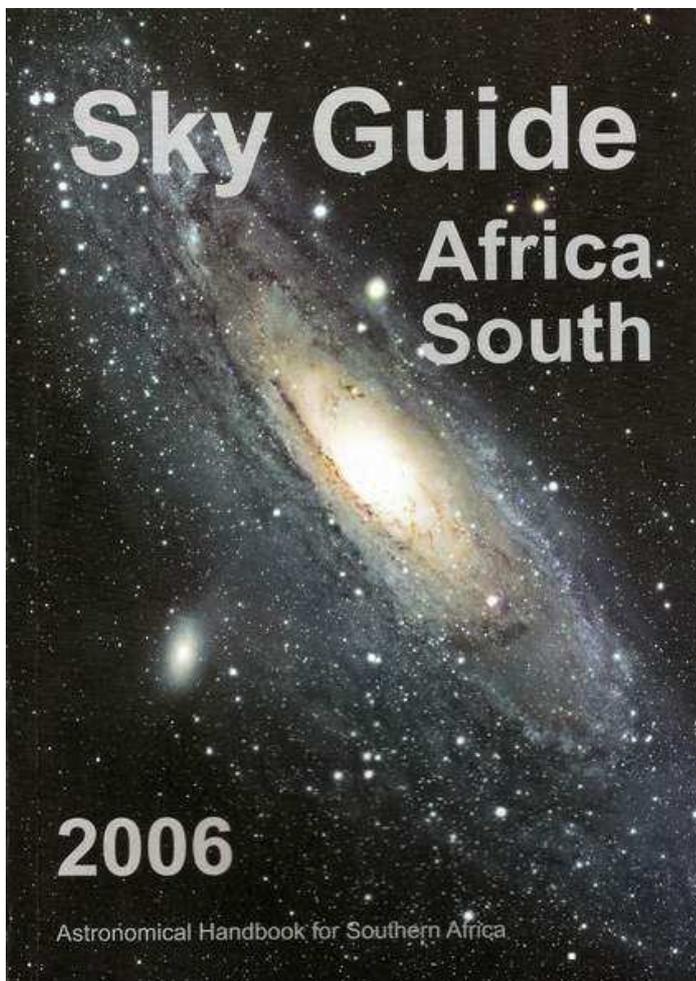
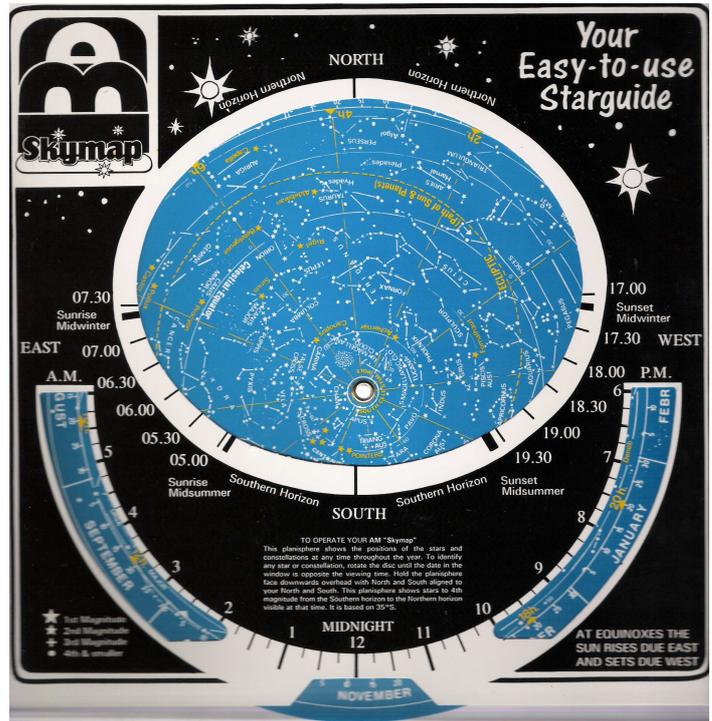
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PO Box 9
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7935

through my looking glass

Ed Finlay

The night sky at this time of the year is full of things to view with the naked eye or some sort of optical aid. To the north the constellation of Orion is high in the sky above the ecliptic; look for the three stars that make up his belt, from left to right Mintaka, Alnilam and Alnitak. Run a line through them to the south (above your right shoulder) and you will see Sirius (Alpha Canis Major), the brightest star in the heavens. From there move north-east (down to the right) and you will come to Procyon (Alpha Canis Minor). Next bring a line almost straight down to the north to Castor and Pollux in Gemini and from there down to the north-west. Just above the horizon you will find Capella (Alpha Aurigae). From there move up to the south-west and you will see the Pleiades (M45) and just above them, Mars. Move to the south-east and you cannot mistake the famous Hyades cluster with Aldebaran the red eye of Taurus.

Above Orion's belt is probably the best object for small telescopes in the sky, M42, the Orion Nebula. To the unaided eye it looks like a hazy, greenish spot but a small telescope will reveal a diffuse emission nebula.

The nebula is a stellar nursery where starburst activity is going on and ultraviolet radiation from the hot, young stars deep in the nebula cause the hydrogen gas surrounding them to glow. You can see four of the stars, known as the "Trapezium" in the centre of the nebula. The Orion Nebula is around 1500 light-years from us in the next arm of the galaxy and in a hundred thousand years or so when radiation pressure has dissipated the obscuring gas and dust observers will see the cluster in all its glory.

In the constellation of Taurus is another interesting object not as visually satisfying as the Orion Nebula but with a fascinating history, the Crab Nebula. I spent many nights trying to see it with 10x50 binoculars, to no avail. At magnitude 9, it requires a dark sky well away from city lights and a four inch telescope to be seen.

In 2447BC a super nova occurred around 3500 light years away and the light from it only reached earth in 1054AD. It went totally unnoticed in Europe (they had bad weather back then too) but was recorded by Chinese astronomers as a "guest star" with an apparent magnitude that made it brighter than Venus at the time.

It is an intense radio source and is expanding at around 1,300 kph., fast enough for the difference in size to be seen in photographs take early in the 20th century and today. At the centre of the nebula is a 16th magnitude pulsar that is spinning at the incredible speed of 30 rotations per second.

The Crab Nebula was first seen by J. Bevis, an amateur astronomer in 1731. It was rediscovered by Messier in 1758 and it became the first object, M1, in his famous catalogue of nebulae. J. Bode and W. Herschel observed it in 1774 but differed on its composition. Bode thought it was a nebula, Herschel thought it was a star cluster. Lord Rosse, at Birr Castle in Ireland discovered its expanding gas filaments and likened it to a “crab’s legs”.

My four inch refractor shows the Crab Nebula as a faint grey smudge against the dark background of the sky. Look for it just below the star Zeta Tauri which forms the end of the upper horn (from our perspective) of the bull.

Aldebaran is a K5 red giant star with an apparent magnitude of 0.86. Its name means “The Follower” in Arabic because it rises after the Pleiades and chases those maidens across the sky. It has a mass of about three solar masses so it will never become a supernova; it will gradually shed its outer layers forming a gaseous shell and be known as a planetary nebula and then finally settle down as a white dwarf star.

Aldebaran has a 13th magnitude red dwarf companion lying about 650 AU away, too far to cause recurrent nova explosions.

More next month,

Ed.



the sky this month

site location: lat. **26.0 deg S** long. **28.0 deg E** local time – UT = **+2.0 hrs.**

february 2006

dd hh		dd hh	
1 21	Mercury 1.8S of Neptune	14 17	Mercury 0.0N of Uranus
3 08	Venus stationary	18 07	Spica 0.4S of Moon Occn
5 07	FIRST QUARTER	20 06	Jupiter 4.8N of Moon
5 22	Mars 2.1S of Moon	21 08	LAST QUARTER
6 06	Neptune at conjunction	21 23	Antares 0.2N of Moon Occn
10 15	Pollux 1.8N of Moon	24 04	Mercury greatest elong E(18)
11 18	Saturn 3.6S of Moon	26 15	Neptune 3.6N of Moon
13 06	FULL MOON	27 20	Moon at perigee
13 17	Regulus 2.5S of Moon	28 02	NEW MOON
14 00	Moon at apogee	28 03	Uranus 1.4N of Moon

march 2006

dd hh		dd hh	
1 04	Mercury 3.3N of Moon	20 19	Equinox
1 11	Uranus at conjunction	21 04	Antares 0.2N of Moon Occn
2 08	Mercury stationary	22 20	LAST QUARTER
5 01	Jupiter stationary	24 14	Mercury stationary
6 06	Mars 2.9S of Moon	25 10	Venus greatest elong W(47)
6 21	FIRST QUARTER	26 03	Neptune 3.5N of Moon
9 21	Pollux 1.7N of Moon	26 03	Venus 5.4N of Moon
10 20	Saturn 3.8S of Moon	26 07	Venus 1.8N of Neptune
12 03	Mercury inferior conjunction	27 16	Uranus 1.2N of Moon Occn
12 23	Regulus 2.5S of Moon	27 19	Mercury 2.0N of Moon
13 01	Moon at apogee	28 06	Moon at perigee
15 01	FULL MOON Penumbral Eclipse	29 12	NEW MOON Eclipse (Not Visible)
17 13	Spica 0.3S of Moon Occn	29 17	Pluto stationary
19 12	Jupiter 4.9N of Moon		

local times of rise and set for the major planets

Date	Sun		Mercury		Venus		Mars		Jupiter		Saturn	
	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set	Rise	Set
Feb 10	5.50	18.58	6.39	19.35	3.24	16.35	13.04	23.45	23.17	12.29	18.05	4.54
Feb 20	5.57	18.50	7.16	19.39	3.01	16.13	12.48	23.23	22.39	11.52	17.23	4.11
Mar 2	6.03	18.41	7.14	19.16	2.48	16.01	12.32	23.03	22.00	11.13	16.41	3.28
Mar 12	6.08	18.31	6.11	18.19	2.44	15.55	12.17	22.45	21.21	10.33	16.00	2.47
Mar 22	6.13	18.21	4.57	17.23	2.46	15.51	12.03	22.28	20.40	9.52	15.19	2.05