Southern Sentinel Crossword

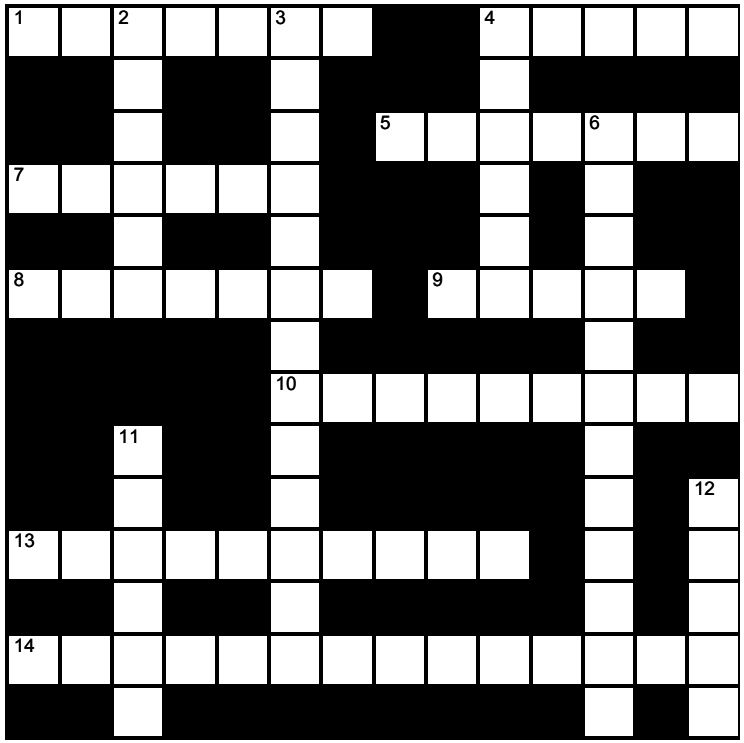
June 2006 Edition

Across

1 What does the R stand for in the H-R Diagram (7)
4 Eighth letter of the Greek alphabet (5)
5 The part of a telescope into which you put the eyepiece (7)
7 Name of the series of Probes to go to the Moon in the 1960's (6)
8 A type of eyepiece design (7)
9 The dark smooth "seas" on the surface of the Moon (5)
10 Aperture divided by power equals what value? (4,5)
13 1990's Martian Probe with a Rover (10)
14 The two points where the projection of the Earth's axis of rotation meet the celestial sphere (9,5)

Down

2 An Australian city with a similar southern declination to Auckland (6)
3 Unique position in the plane of two orbiting bodies where a third body experiences no forces (8,5)
4 Constellation starting with 'T' (6)
6 Astronomer who mapped the 'canals' on the Martian surface (12)
11 Constellation starting with 'A' (6)
12 The percentage of the apparent disk of a celestial body which is currently sunlit. (5)

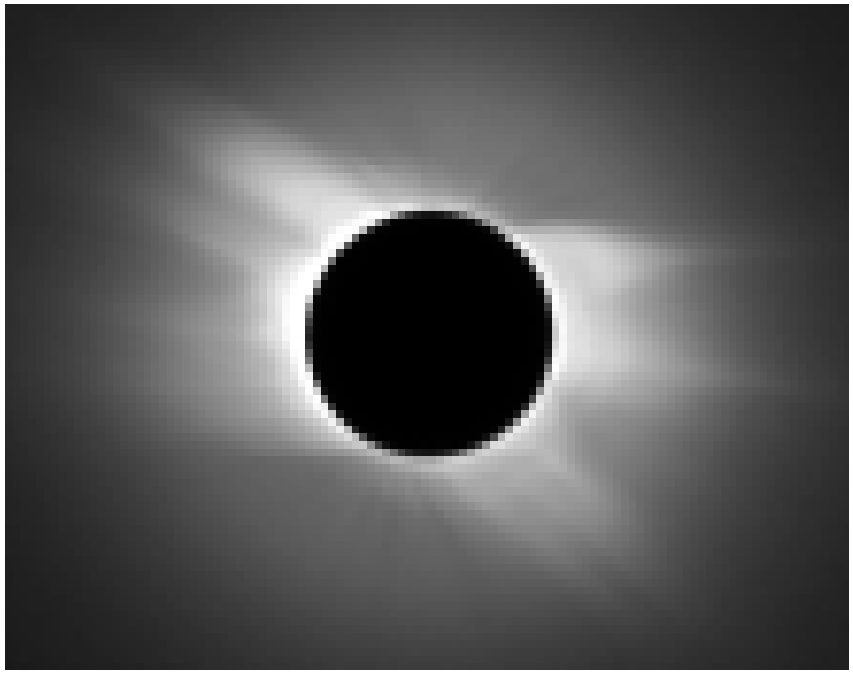


The solutions to the May crossword are on page 31.

AUCKLAND ASTRONOMICAL SOCIETY

SOCIETY JOURNAL
June 2006

Standing in Awe



Credit:Andrew Hinds

The Society meeting this month will be a collective description by several members of the Society of the awesome experience of seeing a total eclipse. In addition there are many other additional events this month including the Carter Memorial Lecture. See inside for details.

JOURNAL OF THE AUCKLAND ASTRONOMICAL SOCIETY

The aim of this publication is to promote and foster the science of astronomy, and to encourage the association of astronomical observers and other persons interested in astronomy.

11 issues per year.

THE SOCIETY COUNCIL

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Contact Us : Auckland Astronomical Society, Inc.,
P O Box 24-187, Auckland, New Zealand

Email : info@astronomy.org.nz
Internet : www.astronomy.org.nz

TRADING POST

Wanted to buy - A 6" / f8 Newtonian Reflector with either alt-azimuth or EQ mount.
Contact - gdc@paradise.co.nz

If you would like to advertise any astronomical equipment in the Journal, please email pfoster@tvnz.co.nz.

SOLUTION TO THE MAY CROSSWORD

Across: 1 Danjon, **5** Vulpecula, **6** Lacaille, **8** Focal, **9** Eye Relief, **10** Gamma, **11** Perigee, **12** Transit.

Down: 2 Jupiter, **3** Polaris, **4** La Palma, **5** Visible Light, **7** Schmitt.

Southern Sentinel Observing List

JOG observers astronomical objects to observe in June

Easy

Objects easy to see or find in small telescopes or binoculars

Coalsack	DN	Crux	NGC 4755	OC	Crux
M 3	GC	Canes Venatici	NGC 4833	GC	Musca
M 83	G	Hydra	NGC 5128	G	Centaurus
NGC 4372	GC	Musca	NGC 5139	GC	Centaurus

Medium

Objects requiring more aperture. A 6 - 8 Inch telescope recommended

NGC 4546	G	Virgo	NGC 5253	G	Centaurus
NGC 4609	OC	Crux	NGC 5286	GC	Centaurus
NGC 4666	G	Virgo	NGC 5307	PN	Centaurus
NGC 4699	G	Virgo	NGC 5363	G	Virgo
NGC 4825	G	Virgo	NGC 5460	OC	Centaurus
NGC 4945	G	Centaurus	NGC 5466	GC	Bootes
NGC 4976	G	Centaurus	NGC 5617	OC	Centaurus
NGC 4995	G	Virgo	NGC 5634	GC	Virgo
NGC 5061	G	Hydra	NGC 5694	GC	Hydra
NGC 5189	PN	Musca	NGC 5746	G	Virgo

Hard

Objects difficult to see or find. A 10 Inch + telescope recommended

NGC 4071	PN	Musca	NGC 5247	G	Virgo
NGC 4691	G	Virgo	NGC 5248	G	Bootes
NGC 4696	G	Centaurus	NGC 5266	G	Centaurus
NGC 4697	G	Virgo	NGC 5315	PN	Circinus
NGC 4753	G	Virgo	NGC 5556	G	Hydra
NGC 4900	G	Virgo	NGC 5595	G	Libra
NGC 4904	G	Virgo	NGC 5605	G	Libra
NGC 4910	G	Virgo	NGC 5728	G	Libra
NGC 4999	G	Virgo	He2-111	PN	Centaurus
NGC 5078	G	Hydra	IC 4191	PN	Musca
NGC 5101	G	Hydra	IC 4406	PN	Lupus
NGC 5102	G	Centaurus	Proxima Cen	Star	Centaurus
NGC 5152	G	Hydra	Circinus Dwrf	G	Circinus
NGC 5170	G	Virgo			

PN - Planetary Nebula G - Galaxy OC - Open Cluster GC - Globular Cluster BN - Bright Nebula
DN - Dark Nebula SN - Supernova Remnant Gal G - Galaxy Group

MONTHLY MEETING

MONDAY 12th JUNE 2006
8.00 PM AT THE STARDOME OBSERVATORY

Eclipse Mania!

Claire Ryan, Roger Feasey and Andrew Buckingham

Solar eclipses are amazing events. They are cyclical and predictable. But they leave an indelible impact on those who are lucky enough to witness them. Three Society members will give their impressions of the solar eclipse of 29 March 2006. For two, it was their first "total". For the third, it was their second. Why travel to distant foreign lands for a few minutes of totality? The reasons were all different. Claire Ryan, Roger Feasey and Andrew Buckingham will each give a brief outline of their path to this eclipse, their impressions and how this experience may effect their future travel plans for places exotic. These presentations will be non-technical and will attempt to communicate the "total" experience of a total eclipse.

Friends and visitors are welcome. The Library will be open from 7:30pm and after the meeting a light supper will be provided.

Calendar of Society Events

June

2	Friday	7:30 PM	**Young Astronomers Group**	**Margaret Arthur**
7	Wednesday	11.00AM	**University Seminar (page 9)**	
			Mapping the Cosmic Labyrinth	**Prof Anthony Fairall**
		7.30 PM	**Carter Memorial Lecture (Page 9)**	
			Living inside the Cosmic Egg	**Prof Anthony Fairall**
8	Thursday	7:30 PM	A.A.S. Council Meeting	
9	Friday	7:00 PM	**Unitec Lecture Event (page 10)**	**Dr Jack Bacon**
		8:00 PM	**Beginner's Guide to the Sky at Night**	
			The three C's: Corvus, Centaurus and Crux	**Dave Moorhouse**
11	Sunday	5.30 PM	**Café Scientifique (page 11)**	
12	Monday	8:00 PM	**Society Monthly Meeting**	
			Eclipse Mania	**Claire Ryan, Roger Feasey and Andrew Buckingham**
16	Friday	8:00 PM	**Night Eyes**	
			Puffing, Eating, Exploding, Hiding, Flashing – Stars	**David Britten**
30	Friday	8:00 PM	**Beginner's Guide to Astronomy**	
			Meteors, Comets, Asteroids and Planetary Impacts	**Steve Calveley**

July

6	Thursday	7:30 PM	A.A.S. Council Meeting	
7	Friday	7:30 PM	**Young Astronomers Group**	**Margaret Arthur**
9	Saturday		**SETI Lecture**	**Dr Jill Tartar**
10	Monday	8:00 PM	**Society Monthly Meeting**	**TBA**
14	Friday	8:00 PM	**Beginner's Guide to the Sky at Night**	**Grant Christie**
21	Friday	7:30 PM	**Night Eyes**	**David Britten**
28	Friday	8:00 PM	**Beginner's Guide to Astronomy**	**TBA**

Just 1.8° further to the south-west lies NGC 5861, a faint, large glow with an SB of around 13. A supernova, 1971D, was discovered within this spiral galaxy on February 24 1971, shining faintly at magnitude 15.5. A few fainter galaxies lie around 5861, needing larger telescopes to see.

North-east of beta and 1° north of delta lies our next target, NGC 5812, a bright, small, round elliptical galaxy with a brighter central region.

Moving 3.8° south and slightly east of beta brings us to NGC 5915 and 5916. The western most galaxy NGC 5915 is the brighter, a face-on barred spiral that appears as a small, round haze. NGC 5916 appears as a fainter, almost edge-on galaxy. Both galaxies show slight brightening towards the middle.

Around 2.2° to the south-west resides NGC 5878, a bright and pretty large spiral galaxy lying almost edge-on. It appears to the eye as an elongated haze with a much brighter central region. A supernova, 1988H, appeared here on the 3 March 1988, shining at a paltry magnitude 15.5, indicative of the great distance that it lay at. Nearby lies a magnitude 6.7 M-type red giant.

There are many other extra-galactic fuzz balls scattered throughout the "*Claws of the Scorpion*", most of them pretty faint. Libra is definitely not a constellation that attacks the senses as far as bright objects are concerned but certainly one that will reward well with care.

Happy hunting.

Night Eyes

June Meeting

Coordinator: David Britten

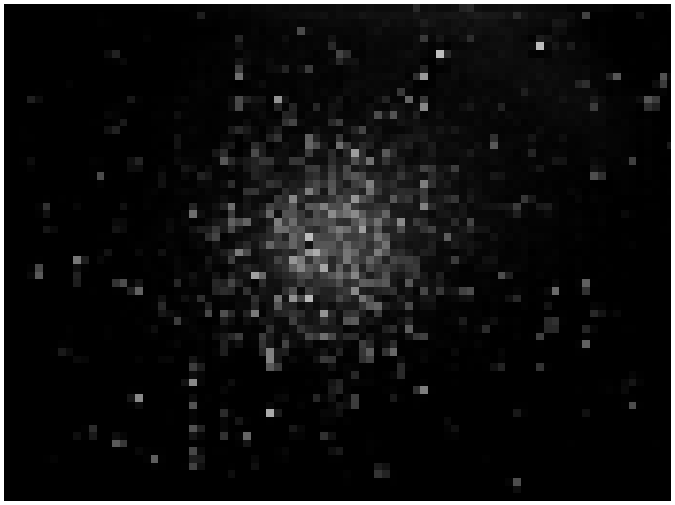
Friday 16th June 8.00pm [not 7.30pm] at the Stardome Observatory

The Night Eyes junior group meeting starts at 8.00pm [**note time change**] in the Observatory Sun Room on Friday 16 June, when the main topic for the meeting will be:

Puffing, Eating, Exploding, Hiding, Flashing – Stars?

Parents, friends and other Society members are very welcome to attend.

For further information please contact:
David Britten at dbritten@xtra.co.nz (ph. 846-3657).



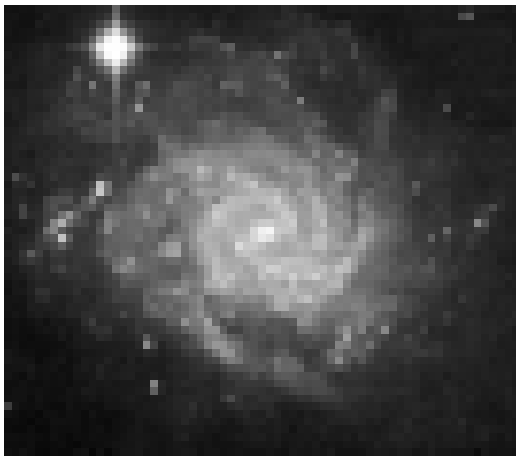
Globular Cluster NGC 5897

enough for the less massive star to have material stripped from its atmosphere.

There is only one "*bright*" deep sky object within Libra's borders. I refer to the large and rather poorly condensed globular cluster NGC 5897. The stars are faint though easily resolved with smaller telescopes. Current studies allocate a distance of 44,800 light years from the Earth.

The easiest planetary nebula in Libra is VV 72, also catalogued as Me 2-1. By easy I mean reasonably bright, however, the size is only 5" or so, making it difficult to perceive as anything other than stellar without high magnification. An 8" telescope with a magnification of 200x will show a greyish disk around 44" to the east of a magnitude 9.8 K-type star. Look for it around 2.5° south-east of NGC 5897.

There are a number of faint galaxies in Libra, all needing dark skies to see. Starting from the bright star beta Librae, move just 51' to the south-west to spy NGC 5885. This large face-on spiral galaxy of surface brightness (SB) 14 will need at least an 8" telescope to pull it from the background.



Spiral galaxy NGC5885.

Society News

Do you think you could take beginners on a tour of the night sky?

If you feel you could take one of the society sessions on the Beginners' Guide to the Sky at Night then please talk it over with Kevin or Olga (09 6259444) or contact a council member.

Astrophotographs published

The current edition (June) of Australian Sky and Telescope carries an article about the Society Astrophotography competition. If you missed the prize giving at the Burbidge Dinner and did not read the article in the March journal then this an opportunity to see the photos in full colour. Congratulations once again to the winners and thanks to all those that entered.

Director of SETI to talk in July

Dr Jill Tartar will be talking in Auckland next month. This talk is being scheduled at AUT for late afternoon on Saturday, July 8th. Final details and subject will be in next month's journal

Join the JOG

Coordinator: Dave Moorhouse
Contact: ph 0274 819 089 **climber@world-net.co.nz**

The JOG (Just another frozen astronomers Observing Group) is an enthusiastic group of local astronomers who gather for observing session where and whenever the skies are clear. They have setup a network, using mobile phone messages, to inform members where they might be going tonight. Although they are very happy to give advise to people, they are primarily focused on using what observing time is available for observing.

If you have your own telescope and what to know more then contact Paul Kemp and David Moorhouse by sending an e-mail with your name and some contact phone numbers to: **climber@world-net.co.nz**.

Beginner's Guide to Astronomy

Coordinator: Steve Calveley (ph: 412-9770)

Meteors, Comets, Asteroids and Planetary Impacts

Friday 30th June 2006
8:00pm at the Stardome Observatory

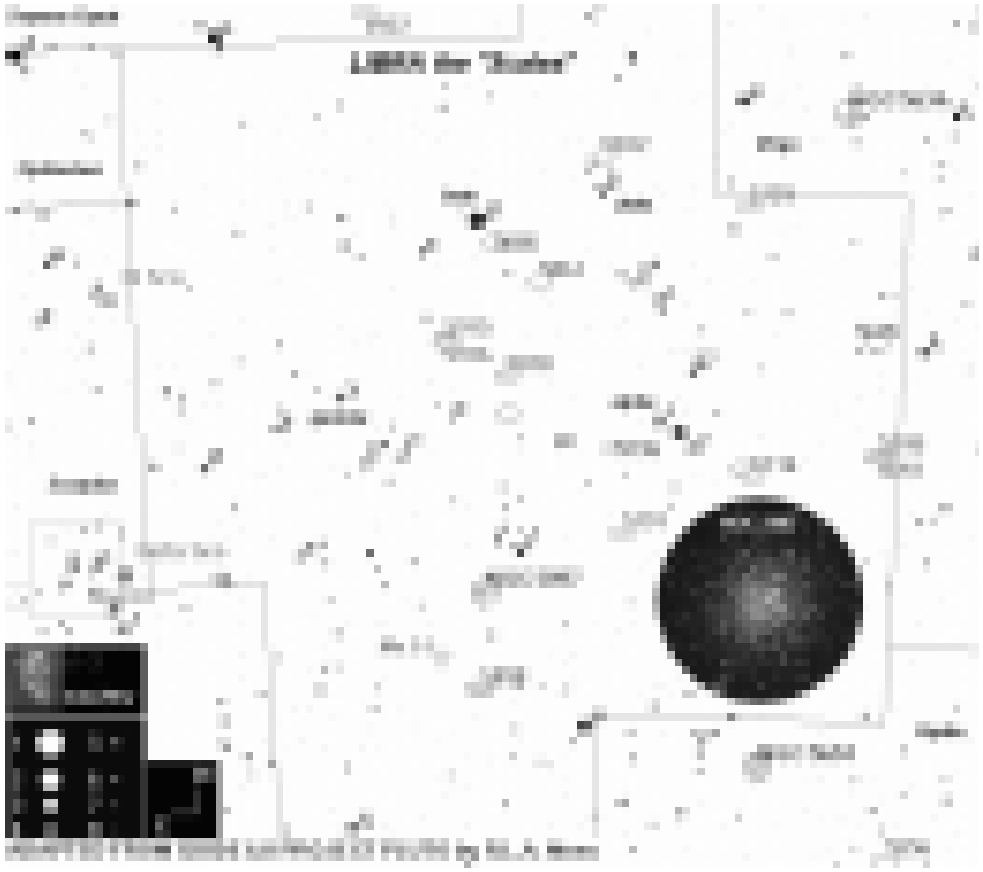
The 'Beginner's Guide to' event is one of the most popular evenings in the Society calendar. These meetings cover all aspects of astronomy in a low key informative way, ideal for those with a new interest in astronomy. If you attend for a full year then you will be eligible for the certificate.

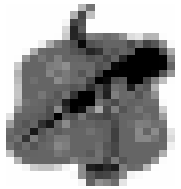
'Beginner's Guide to' also provides a good opportunity to meet other members and feel free to ask any questions you may have. See you there !!

type main sequence star. The computed solar luminosity is 4 and the actual separation from the primary is 4800 AU. The computed distance of this pair is a relatively close at 77 light years.

The A3 star may also be a spectroscopic binary, possibly detected during an occultation of the Moon on May 31, 1966. Photoelectric observations by H.L. Poss and T.R. Kremser with the 36" reflector at Kitt Peak National Observatory showed a separation of 0.01", a difference of 0.4 magnitudes in blue light and an orbital period calculated around 20 days.

Delta is an interesting eclipsing variable star of the Algol type, discovered by Schmidt in 1859. From a maximum of magnitude 4.9, delta falls to magnitude 5.9 in 6 hours. The period of this system is 2.327 days. The primary star, an A-type or perhaps B9.5 main sequence star, has a mass around 2.6 times greater and shines 80 times brighter than our Sun. The secondary star, possibly a G-type, has a mass 1.1 times greater than the Sun. The two stars have an actual separation of 4.5 million miles; therefore they are close





LIBRA
A Balanced View

CosMos

Th' Eternal, to prevent such horrid fray,
Hung forth in heav'n his golden scales, yet seen
Betwixt Astraea and the Scorpion sign;
Paradise Lost (Milton)

The early Greeks saw Libra as the "*Claws of the Scorpion*"; the current usage of Libra as a scale or balance seems to have arrived around the times of the Roman Empire. It appears in the Julian Calendar, devised by Julius Caesar in 46 BC, two years before his death.

The Italians called it Libra and Bilancia, the French Balance, and the German Wage, all meaning a weight or balance. Even the Indians saw it as so, their sacred books mentioning it as Tula, Tulam or Tolam.

To the early Chinese, it was Show Sing, the "*Star of Longevity*" but later cultures saw it as Tien Ching, the "*Celestial Balan*ce". The early solar zodiac has it as a "*Crocodile*" or "*Dragon*".

Libra lies prominently in the June sky, preceding the Scorpion across the sky. At 538° square in size, Libra is one of the larger constellations, though its stars are poorly shown, the brightest attaining magnitude 2.6. In fact, Libra is one of the poorer adorned constellations, there being only 2.4 stars of magnitude 5 and brighter per 100° square.

The brightest star is beta Librae, Zuben Eschamali, from Al Zuban al Shamaliyyah "*The Northern Claw*". Eratosthenes recorded beta brighter than Antares and 350 years later, Ptolemy said it was as bright as Antares. Whether it is Antares that has brightened or beta, which may be variable, is as yet unknown. Beta seems to have a slight variability of 0.03 of a magnitude and is listed as a suspected variable star.

The spectral type is listed as a B8 main sequence star, a little less evolved than Sirius, and the computed luminosity is around 180 Suns, assuming a distance of 160 light years. Stars of this type appear to the eye as blue-white but beta is often claimed to be greenish, even to the naked eye.

One of the earliest records of Mars was perhaps made within this constellation, Ptolemy according a very close approach of Mars to beta as seen from Babylon on the 17th of January, 272 BC. There is some doubt whether the close approach involved beta Librae or beta Scorpii.

Alpha Librae, Zuben Elgenubi, from Al Zuban al Janubiyyah "*The Southern Claw*", shines at magnitude 2.7. This A3 type sub-giant with a luminosity of 37 Suns has a wide naked eye companion of magnitude 5.1. This companion, known as 8 Librae, is an F3-

Feedback

Could you host an exchange student who is interested in Astronomy. Angela Kirby of the EF Foundation recently wrote to us about a young boy called Angel.

I work for EF Foundation which is a non-profit organization, with 40 years experience in expanding cultural awareness in strengthening local communities through traditional student exchange. We provide students from 26 different countries the opportunity to spend up to a year in New Zealand with a volunteer family by giving them the unique experience of life - as a kiwi kid!

We are currently looking for a home for a boy called Angel who is extremely interested in astronomy and we would love to find him a family who shares this interest!

a. Angel is a 15 year old boy from Austria
b. He is fascinated by astronomy and has built up a great deal of knowledge about the subject
c. He also belongs to scouts and enjoys hiking, tennis and cycling!

Angel is a family orientated boy who is very friendly and helpful. If you are interested in hosting Angel then please contact me, details below. Thank you for your support. I hope to hear from you.

Best wishes

Angela Kirby
Regional Manager - New Zealand
Ph: +64 9 302 2082
Email: angela.kirby@ef.com
Website: www.effoundation.org

Young Astronomers

Coordinator: Margaret Arthur

Friday 2nd June 7.30pm
at the Stardome Observatory

If you are interested then come along and join us on the first Friday of the month

well so when it rains (or snows) this second 'wet' detector is set off. The sensor is also heated so that it never dews over and rain is evaporated off the sensor as soon as the rain stops.

Two clever pieces of software collect the data from the sensor. One piece of software, Clarity, talks to the unit and is great for generating local displays and alarms. It can also provide a contact closure to, for instance, close the roof of an observatory if there is heavy cloud or rain. Perhaps you're inside at Waharau waiting for the sky to clear at 1am, the beeper sounds, the sky is clear, or Grant Christie is in the Library doing another of his famous all night variable star runs, the beeper goes off to say it's cloudy go home!

The second piece of software was written by Russell Croman and talks to Clarity to produce a graph. This graph plots both normal ambient air temperature and the sky temperature to show cloud cover. This graph is then FTP'd up to my webpage **http://www.binoscope.co.nz/** every four minutes or so.

The graph on the webpage is of course in colour with white being clear skies at about -25 deg C, then yellow is normally either high thin cloud or passing clouds, red is heavy overcast and blue is rain. It shows the last 48 hours.

This sensor was installed with considerable help from Steve Calveley at his home in Kumeu last weekend (21 May) and is now streaming data continuously live onto the internet so you can see if it's worth the drive to Kumeu to stand and behold the heavens on the next clear night.

If anyone out there feels particularly wealthy I would love to have a second unit in Gisbourne at John Drummond's country residence so we could see if this is a good site for a truly remote robotic telescope!

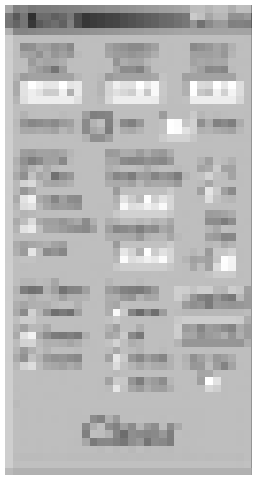
The webpage graph is available at **http://www.binoscope.co.nz/**

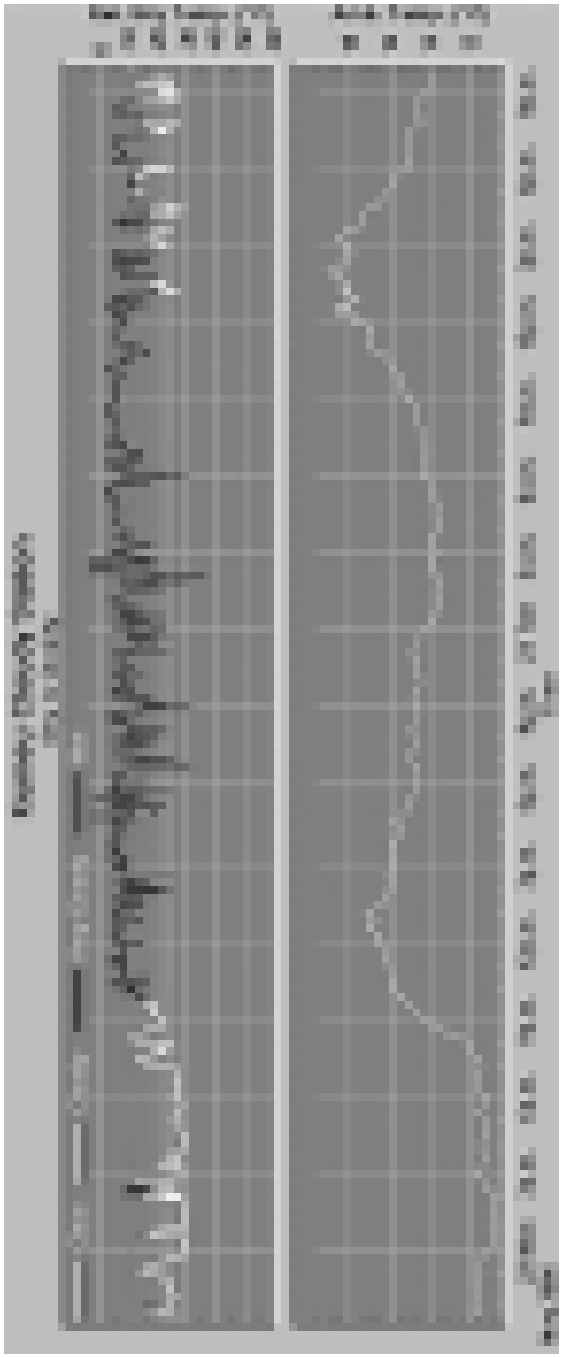
GET THE LATEST ASTRONOMICAL NEWS BY EMAIL

The Society maintains an email service distributing the latest astronomical news items from around the world and throughout the Universe. Currently it is received by over 300 people. The items are moderated so this is not a discussion group but it will help you stay abreast of the latest developments in astronomy.

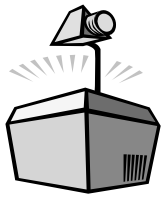
If you would like to receive these messages then send an email (including your name) to:

email.news@astronomy.org.nz





An example cloud cover chart, taken from the web site and the interface dialog boxes from the control software.



Carter Memorial Lecture

Living inside the Cosmic Egg

Anthony Fairall

Professor of Astronomy, University of Cape Town & Planetarium Astronomer Iziko Museums of Cape Town

Wednesday 7th June, 7.30pm

Lecture Theatre SLT1
Physics Department
University of Auckland

The entire visible universe appears to be enclosed within an opaque spherical shell – a 'cosmic egg'. Imprinted on the inside shell of the 'egg' is a remarkable picture of the embryonic universe. The Universe has since expanded enormously and the fluctuations shown in that picture have developed into large-scale structures, within which modern-day galaxies congregate. Each galaxy is literally a city of stars, and within our home galaxy, our Sun is almost lost amongst the stellar multitude. While the scale and general character of the cosmos seems vastly different to the surroundings of our everyday lives, the nature and expansion of our Universe are necessary for our existence here and now.

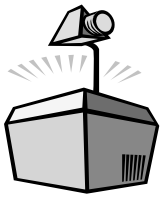
Tony Fairall's research career spans more than 30 years. He has produced some 200 research papers, written a university textbook and three popular-level books, the most recent of which (April 2006) is "Stargazing from Game Reserves". He is an Associate of the Royal Astronomical Society (UK), and a Fellow of the University of Cape Town. He is also a Fellow of the International Planetarium Society.

★ ★ ★

Mapping the Cosmic Labyrinth

Tony is also giving a university seminar on the same day at the same venue (lecture theatre to be confirmed) but at **11.00am**

Our picture of the nearby Universe today is somewhat different to the 'Realm of the Nebulae' opened by Edwin Hubble some eighty years ago. Galaxies are found to congregate into a labyrinth of interconnected 'large-scale' structures separated by giant voids. Various tools allow us to map and quantify characteristics of these structures. In particular this talk will explore the use of percolation techniques and minimal spanning trees. It will also introduce 'Labyrinth' software developed to visualise the large-scale structures. Visualisations of the almost complete 6dF Survey give a more detailed picture of the nearby Universe than has previously been available.



Lectures in June

Dr Jack Bacon
NASA scientist and dynamic speaker

Friday 9th June, 7.30pm

At Unitec Red Lecture Theatre
Bldg 180-B001..
Max 212 seats
Cost $2.00 each
RSVP: **mspencer@aucklandmuseum.com** by 2nd June

Jack Bacon has often been called "A New Carl Sagan." He is an internationally-known motivational speaker, a distinguished lecturer of the American Institute of Aeronautics and Astronautics (AIAA), and one of the most requested speakers in the country for topics concerning technology and the factors that shape human society. A noted futurist and a technological historian, he has written two popular books entitled "My Grandfathers' Clock" and "My Stepdaughter's Watch". A third, The Parallel Bang is due out in 2006. His lectures have captivated tens of thousands of all ages in twenty-six countries on five continents, and he has appeared on numerous radio and television broadcasts. In his daily work, he is on the management team overseeing the construction and operation of the most complicated technical project in history: the International Space Station.

A graduate of Caltech (B.S. '76) and the University of Rochester (Ph.D. '84) his extensive career includes roles in the development of many cutting edge technologies, including controlled thermonuclear fusion, the development of the electronic office, factory automation, and the globalization of business. He pioneered the deployment of several artificial intelligence systems, learning his craft at the famed Xerox Palo Alto Research Centre.

He was the United States' lead systems integrator of the Zarya-the jointly-built spacecraft that forms the central bridge and adapter between all US and Russian technologies on the Space Station. This landmark in technological history was built in Moscow by American and Russian engineers and launched from the Baikonur Cosmodrome in November 1998.

Jack is a fellow of the Explorer's Club, a member of the AIAA and of the National Speakers Association, and was a founding member of the board of directors of the Science National Honor Society (**http://www.ScienceNHS.org**). He routinely advises numerous academic programs and institutions, and he is a champion of education throughout the world.

Sponsored by: Auckland Museum Institute
Royal Sociey of NZ (Contact: Graham Foster 09 8361403)
IPENZ
Auckland Astronomical Society

This is expected to be a very well attended event and a real highlight of the 2006 Science, Technology and Engineering year.

JOG Reports

The Kumeu Cloud Sensor

David Moorhouse

Over the last few years the JOG observing group have been going regularly to the Kumeu Observatory about thirty minutes drive from central Auckland. However, as most of you know, Auckland can get four seasons in one day. Also when you're in South Auckland you have no idea if it's clear, cloudy or raining just thirty or so kilometres farther north and the east coast will be different again. In the past this has meant many evenings looking out the window and seeing stars, packing up the car and driving to Kumeu only to discover it has been cloudy there all day. Then there is the night time problem. If you're in the country on a moonless night you actually can't see the clouds, you can just see a lack of stars.

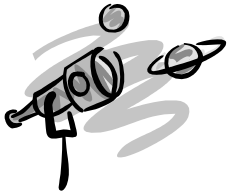
The cloud gauge

Modern technology and the internet have come to the rescue in the shape of the Boltwood Cloud Sensor. I have personally purchased one of these for Kumeu. It is a 250mm x 50mm white plastic tube with a sensor inside and a long cable to a PC. The unit works by a very simple principle. That is the presence of clouds keeps the heat in, so the amount of cloud cover can be determined by taking the sky's temperature. This sensor determines the sky temperature by sensing infrared radiation using a Texas Instruments IR detector with a IR filter on the front to limit the detected radiation into the 8 to 14 micron range. When you then subtract the ambient temperature from the sky temperature you get a surprising correlation between this reading and actual cloud cover. The larger the difference in temperature between the ambient and sky temperature, the clearer the sky. The sensor also has a moisture detector as

On the down side, there are frequent annoying errors. The proof reading has been very inadequate. Spelling mistakes abound (enought, cannnt, radiartion etc). Images have their captions incorrectly mixed. There are number of bloopers "the speed of light is enormous by all our everyday standards, almost 300,000 km/hr". Galaxies with a red shift of 5, are said to be "receding at almost the speed of light". This is a common misconception - the "recession velocities" at such red shifts are far greater than that of light.

Do these annoyances detract from the success of the book? Yes and no, depending more on the attitude of the reader than anything else. Forgetting the errors, this is the best and most accessible summary of relativistic effects in astronomy that I have had the pleasure of reading. I'm sure I'll inevitably dip back into it again.

Reviewed by: Roger Feasey



Beginner's Guide to the Sky at Night

The three C's: Corvus, Centaurus and Crux

David Moorhouse

Friday 9th June 8pm at the Stardome Observatory

High overhead in the early evening, two small and one huge constellation. From galaxies and nebula's to globular clusters this strip of sky has it all. With any luck we will get outside and see these with our own eyes. If you have them bring your planisphere and binoculars.

These informal meetings are designed for people with little or no observing experience, and those who wish to learn their way around the night sky. The sessions are interactive, so feel free to ask questions and generally join in. Also, bring along any "optical aids" you may have (binoculars or telescopes) and hopefully Auckland's weather will be kind to us, and we can go outside and observe what we've been discussing!

Cafe Scientifique (Royal Society of NZ)

World Climate Change - Temporary or Permanent?
What does the most recent evidence tell us?

Dr Jim Salinger, NIWA

Sunday 11th June, 5.30pm to 7.30pm

Stardome Observatory, Manukau Rd, Epsom
RSVP **mspencer@aucklandmuseum.com** by Monday 5th June

Observations show that global warming because of human activities is already producing significant climate change. These are already being observed in melting permafrost in the Arctic severely disrupting traditional Inuit lifestyles, migrating birds are arriving earlier and departing later in North America and there is a third less snow and ice girding the Southern Alps. Climate projections show that other impacts resulting from increasing climate variability and change are likely to be more frequent in the medium term affecting New Zealand agriculture, natural environment, coasts, cities and communities.

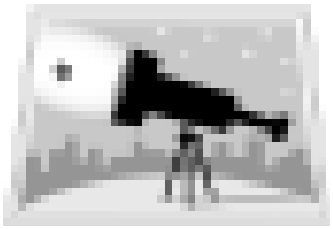
We are trying a new format this time - hope you will join us!

5.30 - 7.30 pm	Please be there by 5.30 pm for catering Cost $5.00 each $3.00 each students Pizzas to be ordered.
6.00 pm	Dinner - Bring and Share a salad or dessert and your own drinks.
6.45 pm	Dr Jim Salinger's talk?

What is Café Scientifique?

Café Scientifique is an informal discussion forum giving like-minded people the opportunity to gather in bars and cafés all over the world to discuss the great topics in science.
The meetings are entirely different from the usual talks and seminars given at universities and institutions around the world. Instead of one person lecturing others, Café Scientifique is designed to promote group discussion. The evening is lead by an invited speaker who talks briefly and without visual aids, the topic is then thrown open to discussion and debate.

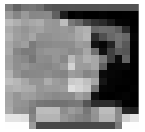
Dr Arne Hendon of United States Navel Observatory and the Amercian Association of Variable Star Observers will hopefully be talking in the last week of June. Watch other sources for final details.



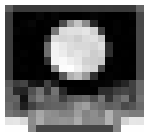
The Sky This Month

Phil Foster

All times in NZST (UT + 12hrs) and are for Auckland.

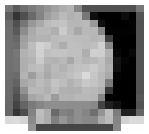


DATE	RISE	SET
01 June 06	0725	1713
15 June 06	0732	1711
30 June 06	0735	1714



	DATE	TIME	RISE	SET
First Quarter Moon	04 June 06	1105	1259	0039
Full Moon	12 June 06	0605	1617	0758
Last Quarter Moon	19 June 06	0210	0016	1239
New Moon	26 June 06	0407	0810	1720

	DATE	RISE	SET
Mercury	01 June 06	0843	1804
Mercury	30 June 06	0856	1702
Venus	01 June 06	0418	1520
Venus	30 June 06	0511	1511
Mars	01 June 06	1054	2039
Mars	30 June 06	0956	2013
Jupiter	01 June 06	1532	0501
Jupiter	30 June 06	1333	0259
Saturn	01 June 06	1120	2123
Saturn	30 June 06	0936	1944
Uranus	01 June 06	0027	1311
Uranus	30 June 06	2233	1118
Neptune	01 June 06	2225	1202
Neptune	30 June 06	2030	1007
Pluto	01 June 06	2225	0819
Pluto	30 June 06	1636	0618



A good month to try to spot Mercury. As the month progresses it climbs higher into the evening sky just after sunset. It is at greatest elongation on the 21st. A crescent Moon passes by on the 28th.

are neither footnoted, end-noted or listed in an appendix. Those keen to follow up with the original material are left to their own devices.

The book is far more than a dry discussion of matters relativistic and astrophysical. Interesting interludes abound - a random sample follows:

- What is the easiest white dwarf to see in your telescope? Keel's suggestion, omicron-2 Eri; I'll have to try it and see.
- He describes modifications to the spider of a 61cm telescope at Vanderbuilt University to enable easier public viewing of Sirius B (also a white dwarf) by greatly reducing the diffraction effects - worth a go for the Zeiss, Mr. Curator of Instruments?
- He discusses how Eddington's treatment of the gravitational red shift of white dwarfs, initially confirmed by inadequate measurements, mislead astronomers for 40 years, such was Eddington's reputation.
- He describes the effects of relativistic travel speeds on the appearance of the sky, and how science fiction gets them wrong.
- He discusses (and shows) the effects of cosmic rays on CCD detectors, and how the algorithm used by Hubble Space Telescope astronomers to remove these artefacts, also removes any fast moving asteroids on the image.
- He discusses the disadvantages of being well ahead of your time in science, which he defines as greater than three years.

There are plenty of pictures, the vast majority monochrome. Image quality is average at best, as too is the relevance to the subject matter being discussed. Eight colour images are collected in the centre of the book - these are also reproduced in monochrome within their respective chapters. Each chapter has a further reading list with a few useful web sites. There is an index, but no appendices.

What is the target audience of this book? Being equation-free, is this a book ideal for the absolute novice in astronomy or relativity? Not really, in either case. For example Keel mentions many types of telescopes in passing, and their equipment. He rarely provides background information. This is fine for the moderately knowledgeable amateur but would inevitably confuse a novice. As for explaining relativity, what it is and what it predicts, there is nothing formal - again the reader is expected to have an adequate background.

Is this a book for the serious astronomer or relativist? Definitely not. Its lack of equations and its informality remove it totally from the realms of text books. So the book appears to be aimed at the middle ground, at well informed laymen with some knowledge of astronomy, relativity and a broad interest in the Universe, who are keen to gain some understanding of the tricks that relativity can play with reality. In this aim, the book succeeds.

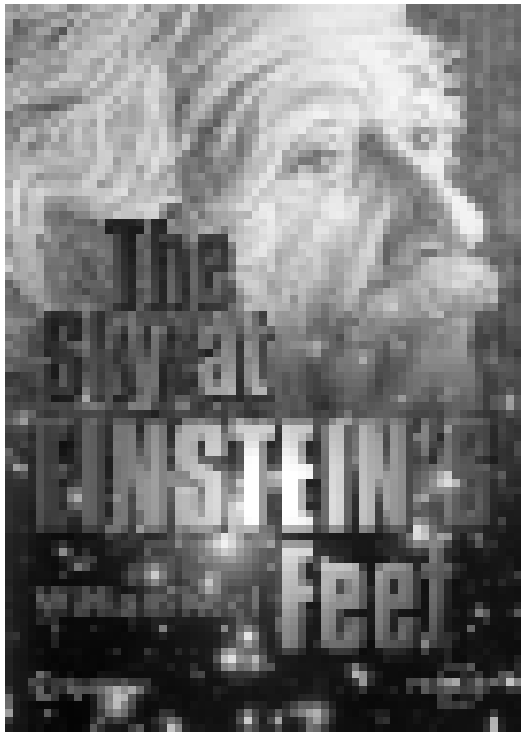
Book Reviews

The Sky at Einstein's Feet

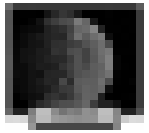
Author: William Keel
Publisher: Praxis

Any time one finds a book with Einstein's picture and name on the cover, one fears the contents. Will it be the same "introduction to relativity without mathematics" that has appeared in countless volumes over the last century? Although it is almost equation free, except for the inevitable $E = mc^2$, this book is a pleasant surprise in most respects.

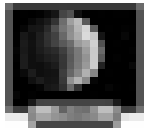
The principal theme of the book is relativistic effects on astronomical and astrophysical observations, and how what is observed, may be far from reality, when relativity is involved. These effects are discussed in an easy going and very readable style. Except for a modest number of blemishes, Keel (a professor in the Department of Physics and Astronomy at the University of Alabama) appears on familiar territory as he discusses in almost 250 soft cover pages, light echoes, quasars, superluminal motion, gamma ray bursts and beams, micro-quasars, white dwarfs, neutron stars, cosmic rays, synchrotron radiation from galaxies, gravitational lensing (both galactic and stellar), black holes and the shape of the Universe.



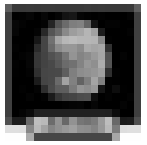
In each of these areas, he provides a brief historical development of the subject and the contribution that deciphering the relativistic effects made to the overall understanding of the processes occurring. Anecdotes abound, covering dead ends, disagreements and other items which are rarely mentioned in the formal publications. The material includes much "name dropping" giving credit to those who finally published the paper(s) which finally resolved the problem at hand. But these references



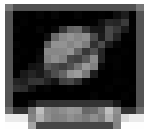
Venus has now dimmed but at Magnitude –3.9 is still the brightest object in the sky before sunrise. A crescent Moon passes 6° away on the 23rd.



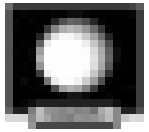
Mars is still visible in the early evening sky but is now setting by 8.30pm. On the 15th/16th it passes right through the centre of the Beehive cluster (M44) emerging on the other side to pass with 20 arcmins of Saturn.



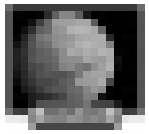
Jupiter is very well placed overhead in the middle of the night and makes a good object for binocular observation.



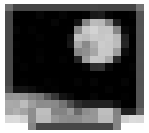
Saturn is now starting to move closer to the Sun. A well timed early evening observation will find it near the Beehive cluster. On the 28th, Saturn, Mercury, Mars and a crescent Moon are all with a 15° portion of the sky.



Uranus progresses into the evening sky rising by 10.30pm by the end of the month. A easy object for a modest aperture.



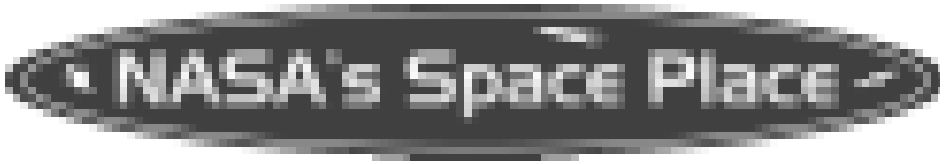
Nepture, like Uranus, moves into the evening sky, rising at 8.30pm by the month's end.



During May, Pluto transits from East to West at about midnight.. This makes it a good time for patience observers with a 20cm telescope to find some dark sky and hunt down this elusive planet. Good star chart required.

References

Skymap
http://sunearth.gsfc.nasa.gov/eclipse/TYPE/TYPE.html



Not a Moment Wasted

Dr. Tony Phillips

The Ring Nebula. Check. M13. Check. Next up: The Whirlpool galaxy.

You punch in the coordinates and your telescope takes off, slewing across the sky. You tap your feet and stare at the stars. These Messier marathons would go much faster if the telescope didn't take so long to slew. What a waste of time!

Don't tell that to the x-ray astronomers.

"We're putting our slew time to good use," explains Norbert Schartel, project scientist for the European Space Agency's XMM-Newton x-ray telescope. The telescope, named for Sir Isaac Newton, was launched into Earth orbit in 1999. It's now midway through an 11-year mission to study black holes, neutron stars, active galaxies and other violent denizens of the Universe that show up particularly well at x-ray wavelengths.

For the past four years, whenever XMM-Newton slewed from one object to another, astronomers kept the telescope's cameras running, recording whatever might drift through the field of view. The result is a stunning survey of the heavens covering 15% of the entire sky.

Sifting through the data, ESA astronomers have found entire clusters of galaxies unknown before anyone started paying attention to "slew time." Some already-known galaxies have been caught in the act of flaring – a sign, researchers believe, of a central black hole gobbling matter from nearby stars and interstellar clouds. Here in our own galaxy, the 20,000 year old Vela supernova remnant has been expanding. XMM-Newton has slewed across it many times, tracing its changing contours in exquisite detail.

The slew technique works because of XMM-Newton's great sensitivity. It has more collecting area than any other x-ray telescope in the history of astronomy. Sources flit through the field of view in only 10 seconds, but that's plenty of time in most cases to gather valuable data.

The work is just beginning. Astronomers plan to continue the slew survey, eventually mapping as much as 80% of the entire sky. No one knows how many new clusters will be found or how many black holes might be caught gobbling their neighbours. One thing's for sure: "There *will* be new discoveries," says Schartel.

Tap, tap, tap. The next time you're in the backyard with your telescope, and it takes off for the Whirlpool galaxy, don't just stand there. Try to keep up with the moving eye-

"pancake" galaxies themselves do not participate in the general expansion. Note also that our hypothetical two dimensional universe expands into a third dimension (from which we can observe). This part of the analogy does not apply to our Universe; it does not expand into an extra dimension, it merely expands.

The expanding rubber sheet universe can be shown to obey the velocity – distance law (Equation 3). Therefore for any galaxy in this hypothetical universe (and in the real Universe), there will be a distance (known as the Hubble Length) at which other galaxies are receding at the velocity of light. At less than that distance, recession will be subluminal, at greater distances it will be superluminal. Re-writing Equation 3 with the recessional velocity equal to the speed of light (c)

$$c = H_0 \, d_{\text{hubble}}$$

giving

$$d_{\text{hubble}} = c \, / \, H_0$$

So the Hubble Length (d_{hubble}) is dependent on the value of the Hubble Constant. Until resolved within the last decade by the Hubble Space Telescope observations of cepheid variables in galaxies out to about 100 million light years, the Hubble Constant was known only to be in the range 50 – 100 km/s/Mpc. These values would give Hubble Lengths of 6,000 Mpc and 3,000 Mpc respectively (19,560 million lyr to 9,780 million lyr respectively).

If the rate of change of distance between galaxy clusters never changed, the Hubble Constant would truly be constant over eternity. However if the rate of change of separation with distance has not remained constant throughout the history of the universe, then the Hubble Constant will have changed.

Given that we know our Universe has been expanding, we suspect at variable rates since the Big Bang, we infer that the Hubble Constant must have changed over the history of the Universe. Assuming that the speed of light (c) has remained constant, the Hubble Length has therefore changed over the life of the Universe. So what is the history of the Hubble Constant and Hubble Length, how have they changed in time, and how have those changes effected the detectability of the most distant objects in our Universe? Is there any ultimate limit of detectability within the life of the Universe?

Part 2 will reveal.

[1] Hubble, E. Proc. Natl. Acad. Sci., 15, 168

[2] Carroll, B.W. and Ostlie, D.A. *An Introduction to Modern Astrophysics*, Addison-Wesley, 1996

[3] Davis, T.M. and Lineweaver, C.H. *Expanding Confusion: common misconceptions of cosmological horizons and the superluminal expansion of the universe*, arXiv:astro-ph/0310808 v2, 13 Nov 2003

$$z = \sqrt{\frac{1 + v_{rec} / c}{1 - v_{rec} / c}} - 1 \qquad (5)$$

and solving for v_{rec}/c which gives

$$v_{rec} / c = 0.945$$

that is, the quasar is receding at 94.5% of the speed of light! Eureka – subluminal after all!

This methodology is frequently used to demonstrate that objects with high red shift (z) are still receding subluminally. That is, after all, why we can detect them, isn't it?

Wrong, totally and utterly wrong! Not only in theory, but experimentally[3]. We can see objects that were receding from us at greater than the speed of light when they emitted the radiation that ultimately found its way to Earth. Nonsense you say? Please read on.

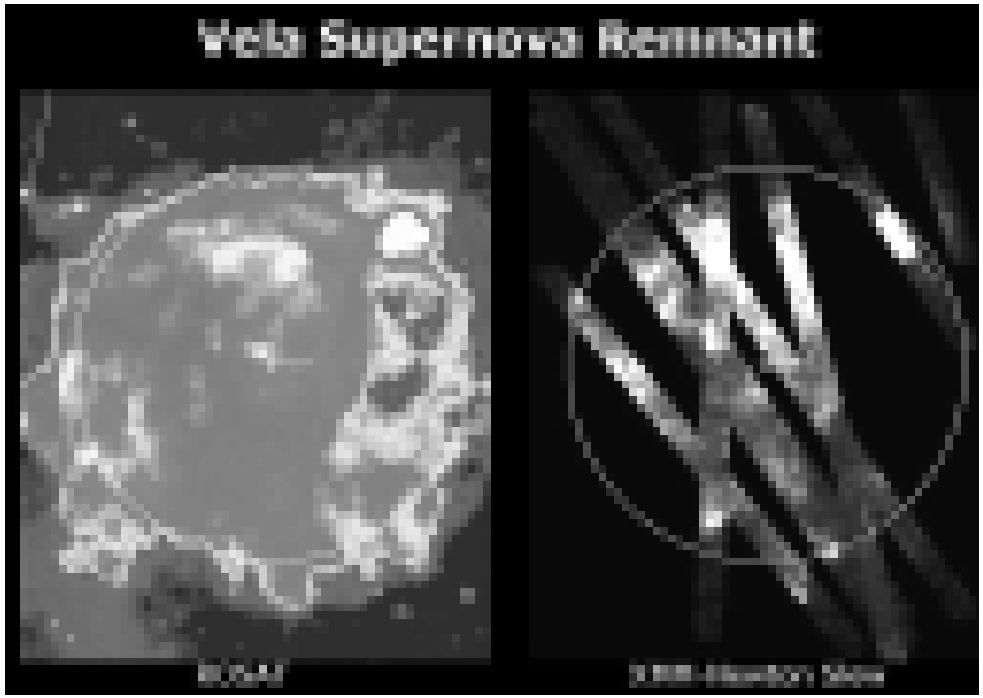
The fundamental mistake with such treatment of high red shift objects, is that special relativity is a "local" theory. Special relativity (and the relativistic doppler formula) does *not* apply to the universe on the large scale. The universe is governed by general relativity (G.R.), which has something very different to say about the same observational evidence.

First, in G.R., the red shift is primarily unrelated to the velocity of an object through space. All objects, stars, galaxies and galaxy clusters, do move through space locally. The velocities typically range from hundreds of km/s for stars within their galaxy through to a few thousands km/s (at most) for galaxies and galaxy clusters. Locally, the stars and galaxies within a cluster obey special relativity. So our galaxy and the local group are moving at a local velocity of 630 km/s relative to the reference frame provided by the cosmic microwave background, towards the Hydra-Centaurus super-cluster. But this velocity has effectively nothing to do with the "velocity of recession" between us and the distant galaxies and quasars.

G.R has a different interpretation of the red shift of distant galaxies. Except for the actual motion of a galaxy through its local space (which is actually called its peculiar velocity), the red shift results from the expansion of space between the galaxy clusters, and is cosmological in nature (in fact it is known as the cosmological red shift). Now this is not just playing with semantics, but has major consequences.

It must be emphasised that the velocity – distance law (Equation 3, $v_{rec} = H_0\, d$) arises automatically out of G.R. theory if one assumes any expanding universe is homogeneous and isotropic. Conversely, the red shift – velocity law (Equation 1, $v_{rec} = c\, z$) is an observational approximation, first established by Slipher and Hubble.

Imagine a two dimensional universe in the form of an infinitely large, infinitely stretchable rubber sheet. Galaxies (like two dimensional pancakes) are embedded in the two dimensional rubber surface. As it is stretched, the rubber sheet expands uniformly in all directions, increasing the average separation between any two galaxies. Note that the



The image on the left is the Vela Supernova Remnant as imaged in X-rays by ROSAT. On the right are some of the slew images obtained by XMM-Newton in its "spare" time

piece. Look, you never know what might drift by.

See some of the other XMM-Newton images at **http://sci.esa.int**. For more about XMM-Newton's Education and Public Outreach program, including downloadable classroom materials, go to **http://xmm.sonoma.edu**. Kids can learn about black holes and play "Black Hole Rescue" at The Space Place, **http://spaceplace.nasa.gov/**, under "Games."

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

*This section is provided by NASA's Space Place. They have a good website at **http://www.spaceplace.nasa.gov** with fun and interesting resource for children and teachers.*

Superluminal (Part 1)

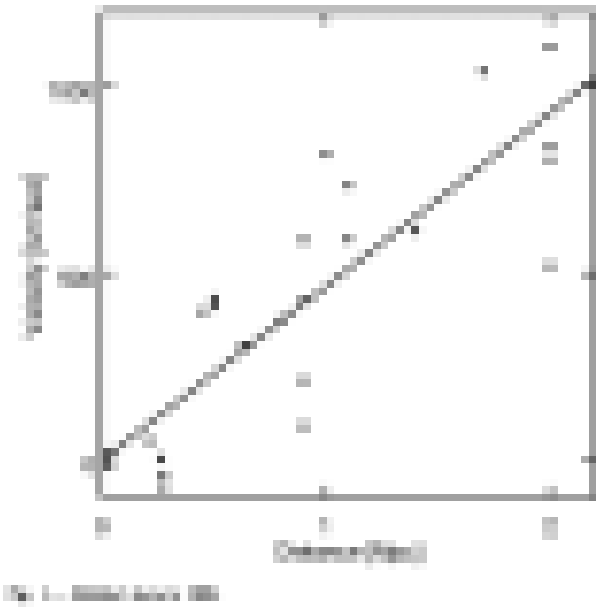
Roger Feasey

It is now with some regularity we read that a quasar or faint galaxy has been detected at a red shift (z) of 6 or more, implying that we are seeing it as it was less than a billion years after the Big Bang. Such progress results from a vast improvement in detection efficiency compared with a few decades ago, when in the era prior to use of CCD cameras, photographic plates could rarely measure red shifts beyond 0.5. For example, even the earliest quasars discovered in the 1960s were at red shifts of $z < 0.2$.

Those of a certain age or a penchant for old astronomy books, with photographs of ever more distant fuzzy galaxies or galaxy clusters, plus even less distinct photographically imaged spectra, captioned with their red shifts and velocity of recession. For example the Virgo galaxies were at $z = 0.004$ and a recession velocity of 1,200 km/s, Ursa Major with z =0.05 at 15,000 km/s, Bootes with $z = 0.13$ at 39,000 km/s and Hydra with $z = 0.20$ at 61,000 km/s. In all cases, the red-shift was treated as a Doppler shift, and the velocity of recession was derived from:

$$v_{rec} = c\, z \qquad (1)$$

where v_{rec} = velocity of recession in km/s
c = velocity of light (300,000 km/s)
z = red shift



Hubble's velocity of recession versus distance data in 1929.

Most modern text books still present much the same material. And it is wrong, or at least not universally correct!

That other galaxies were almost universally receding from us (as shown by their red shift) was determined in the early 20th century by Slipher, but it was Hubble[1] who originally presented data relating red shift and distance.

$$z = constant \times d \qquad (2)$$

where z = red shift
d = distance

Subsequently the relationship was restated (on theoretical grounds) in terms of a relationship between velocity of recession and distance;

$$v_{rec} = H_0\, d \qquad (3)$$

where d = distance
and H_0 = Hubble's Constant

If the distance is measured in megaparsecs (a parsec is 3.26 light years so a megaparsec is 3,260,000 light years) and velocity in km/s, Hubble's Constant has the units km/s/Mpc; the currently accepted value is $H_0 = 70$ km/s/Mpc.

These various expressions of Hubble's Law, often used interchangeably, have led to generations of astronomers and cosmologists, both amateur and professional, having a major misunderstanding of how the universe really works.

Consider what happens when, with increasing red shift, the inferred velocity of recession approaches or exceeds the speed of light, 300,000 km/s. As determined by Einstein, the speed of light is an absolute and cannot be exceeded. Logic tells us therefore, that once an object reaches a velocity of recession of 300,000 km/sec, it will suffer an infinite red shift and become undetectable. This erroneous concept has been propagated either directly or indirectly through generations of astronomy books as has the (incorrect) use of relativity to overcome this "problem".

As an example of the latter problem solving technique, one of my favourite reference texts for matters astrophysical[2], considers the real velocity of recession of quasar PC 1247+3406, which has a measured red shift of $z = 4.93$, which at the time of its writing in the middle 90's, was the maximum red shift ever detected. The red shift was deduced from the measured wavelength of a hydrogen emission line being 0.7214 microns whereas in its own rest frame, the emission would be at wavelength 0.1216 microns. The red shift (z) was correctly deduced from the change between observed and emitted wavelengths:

$$\begin{aligned} z &= (\lambda_{obs} - \lambda_{rest}) / \lambda_{rest} \qquad (4) \\ &= (0.7214 - 0.1216) / 0.1216 \\ &= 4.93 \end{aligned}$$

The red shift (z) was then converted into a velocity of recession v_{rec} by using the special relativistic doppler formula (5) derived from Einstein's Special Theory of Relativity,