



AUCKLAND
ASTRONOMICAL
SOCIETY

July 2011

SOCIETY JOURNAL

Society Meeting Monday July 11th 8:00pm
Space Science Tour With Peter Felhofer



**Peter Felhofer looking at Mars through the 24 inch Alvan
Clarke Refractor at the Lowell Observatory in Arizona.**

With the retirement of the Space Shuttle programme this year and the Hubble Space Telescope in its final phase I decided this was the last chance to catch a shuttle launch. Additionally I wanted to get an insight into what was next for NASA and Space exploration in general, given that the two big public relations success stories are coming to an end.

So off I went chasing a moving target with an initial launch date of April 18. Going so far for one event was a risky venture so I made a point of visiting as many NASA sites, Observatories and

Space Science institutions as I could. This month I'll share with the society my experience and the information I gathered from Hubble's backyard at Mt. Wilson and Mt. Palomar, Lowell's legacy in Flagstaff, Arizona and the National Optical Astronomical Observatory at Kitt Peak, Arizona. Then it's on for a back of house tour of the Johnson Space Center in Texas and launch time at Kennedy Space Center, plus plenty of other sites.

June Society Meeting

Voyaging Beyond Earth: The Observatories of Maunakea

Report by Clive Bolt

This was the first time that the Society had been able to organise an international speaker for a Society Meeting using remote connection. The connection was made through Skype and typically worked well for part of the time but required constant reconnection. Andrew Shawn's PowerPoint presentation was projected locally onto the main screen while the audience were able to see Shawn on a computer screen. For a first attempt it showed real potential.

Shawn is the Planetarium Manager for the Imliloa Astronomy Centre in Hawaii. He has had 30 years working in that field and consequently he was a very good speaker. There was a two-hour time differential so Shawn gave his talk from his home in Hawaii.

The observatories in Maunakea are sited near the summit of the volcano at an average altitude of about 4,200 metres above sea level, above about 40% of the atmosphere and the majority of the moisture in the atmosphere. There are some 13 telescopes or groups of telescopes in the complex, including optical and optical plus infra red. There are two sub-millimetre radio telescopes and an array of 6 sub-millimetre antennae. There is also one radio telescope that is part of the long Baseline Array.

Among the most impressive are the two Keck telescopes with 10 metre mirrors fitted with adaptive optics and capable of resolution at least as good as the Hubble Space Telescope (which has a 2metre mirror). The capability of the Keck telescopes was demonstrated by a very high-resolution image of the Lagoon Nebula that was generated as part of a study of Herbig-haro objects, young stars that eject high velocity gas. Another study showed an image of the most distant galaxy so far located. The galaxy is visible by gravitational lensing using the mass of a galaxy-cluster in the foreground. The galaxy is believed to have formed as little as 200 million years



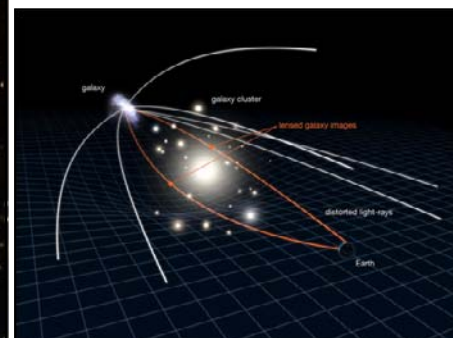
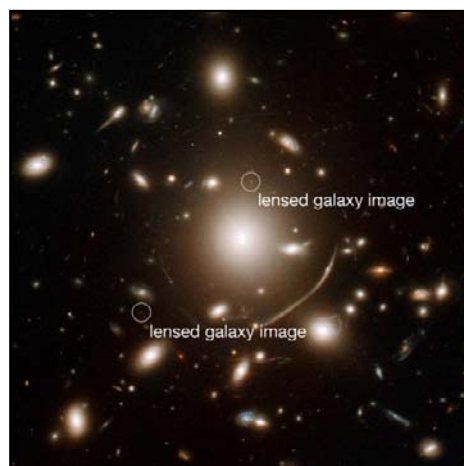
The Gemini Telescope in time lapse with the laser guide star making the red display in the sky.

after the "Big Bang" and is actively forming stars, or it was when the light we see now left the galaxy nearly 13.1 billion years ago. Also of interest is an image of Pluto showing the carbon monoxide atmosphere stretching almost half-way to Pluto's moon, Charon.

Infra Red is valuable as a tool to "see" through the cloud of gas and dust that obscures the central bar of the Milky Way. It was amazing to see the difference in the richness of the field of view of a globular cluster seen in infra red, as compared to visible light.

The next telescope proposed for Maunakea is a 30 metre telescope with adaptive optics estimated to cost between 8 and 10 billion dollars. The annual running cost of a large telescope is generally found to be 10% of the capital cost of the project! Shawn explained that cultural issues were a significant factor in gaining approval to proceed with new projects.

It was a very successful evening and a very interesting and well-presented talk. Our thanks to Shawn for taking the time to talk to us and to Andrew for organising the presentation.



Gravitational lensing used to image the most distant galaxy so far studied at just 200 million years after the "Big Bang"

Calendar of Events for 2011

July Programme

Fri	1	7:30pm	Young Astronomers
Mon	4	8:00pm	Practical Astronomy with Andrew Buckingham
Mon	11	8:00pm	Society Meeting with Peter Felhofer
Mon	18	8:00pm	Film Night with Gavin Logan
Wed	20	7:30pm	Council Meeting
Mon	25	8:00pm	Introduction to Astronomy with Bernie Brenner

Practical Astronomy Monday 4 July 8:00pm Andrew Buckingham & Ivan Vazey

This session will be a guide in using and maintaining your telescope and will include a guide to some of the various telescope accessory options available. We will have a range from the Society's rental collection to practice on. This will give you a great opportunity to see what is available and to try them out. Members are encouraged to bring along their own telescope to practice with and to get advice.

Welcome to New Members

Avi Charlton Diesch (youth)	Simon Draper (family)
Ian Westlake (family)	Marnie Weston (ordinary)
Wendy Smith (family)	Mark Anthony Higgins (ordinary)
Sally Izod (ordinary)	Fiona Ramsey-Turner (ordinary)
Peter Mellers (ordinary)	

August Programme

Mon	1	8:00pm	Practical Astronomy. Globular Clusters with Bill Thomas
Fri	5	7:30pm	Young Astronomers.
Sun	7	2:30-3:30pm	Dr Brian Henshall talk at the Stardome.
Mon	8	8:00pm	Society Meeting. TBA
Sun	14	10:00am-2:00pm	Bring and Buy
Mon	15	8:00pm	Film Night with Gavin Logan
Wed	17	7:30pm	Council Meeting
Mon	22	8:00pm	Introduction to Astronomy with Bernie Brenner

Film Night Monday 18 July 8:00pm With Gavin Logan

Journey through the Milky Way.

This documentary takes you on the ultimate trip, an imaginary journey through the Milky Way. Made in 2011, it has some great graphics and imagery mixed with interviews with leading scientists. It also covers some of the latest facts and theories about Dark Matter, other Solar Systems, Black Holes and Star Formation.

Film is 1 hour and 30 minutes long.

Member Survey

The council would like to know what your preference is for the meeting times, either 7:30pm or 8:00pm. Do you attend regularly, occasional or rarely and if the meeting time changed, would it make a difference to you. Would you be more likely or less likely to attend. Please respond to the email survey notice or contact Andrew by phone on 09 473 5877

If you have any questions or comments you wish to make please contact Andrew Buckingham on 09 473 5877

or by email at treasurer@astronomy.org.nz.

The Winter Star Party

Report by Gavin Logan

June's Winter Star Party had to remain indoors because of cloudy, showery weather. Presenter, Claire Ryan showed the audience what to look for in the winter sky and highlighted information about some of the constellations. Instead of the planned telescope viewing, this was followed by a planetarium show called "Big".

"Big" is narrated by Sir Richard Attenborough and uses a light-hearted storytelling style, combined with computer animation to explore the question of just how big the Universe is. Concepts such as the speed of light were explained as the show took the audience on a tour around the Universe and out to the limits of



An entertaining computer animated character from the planetarium show Big



A large audience of society members watching the winter night sky as displayed by the planetarium as presenter Claire Ryan points out the highlights.

the observable Universe. A large range of celestial objects was shown.

"It has been said that the best accessory for a telescope is an observatory"

PIGEON MOUNTAIN

PODs available in 6 Standard Configurations



POD-XL 5 wall panels, a door panel and a 4 quadrant clamshell design revolving dome.

POD-XL1 4 wall panels, a door panel and 1 work bays, plus 4 quadrant clamshell design revolving dome.

POD-XL2 3 wall panels, a door panel and 2 work bays, plus 4 quadrant clamshell design revolving dome.

POD-XL3 2 wall panels, a door panel and 3 work bays, plus 4 quadrant clamshell design revolving dome.

POD-XL4 1 wall panels, a door panel and 4 work bays, plus 4 quadrant clamshell design revolving dome.

POD-XL5 A door panel and 5 work bays, plus 4 quadrant clamshell design revolving dome.

Optional work bays can be added later as required.

Each POD comes with DeepSky Planetarium software for running your telescope.

With a POD you can be out observing in minutes on any night of your choice, leaving your equipment permanently set up.

No need to re-align your scope between each session.

You'll wonder how you managed before POD.

You can also be assured that your valuable gear stays dry and safe, year round through any weather.

For colours & models contact Ivan at ivazey@surfer.co.nz

<http://pigeonmountainobs.co.nz>

New Zealand agents for SkyShed POD

Film Journey to Uranus and Neptune

Report by Gavin Logan

Film night attendance keeps growing with nearly 70 Society members coming in June to watch a documentary on Uranus and Neptune, the two farthest planets from Earth and what would be involved in travelling there.



A packed room watched an intriguing documentary on Uranus and Neptune.

The film gave interesting facts about Uranus and Neptune. Uranus is an icy gas giant with an atmosphere composed of a cocktail of hydrogen, helium and methane. It is so distant from the Sun that its orbit takes 84 years. Neptune is its vibrantly blue neighbour and takes nearly twice that long to orbit the Sun. It has record winds that howl around its equator at nearly twice the speed of sound.

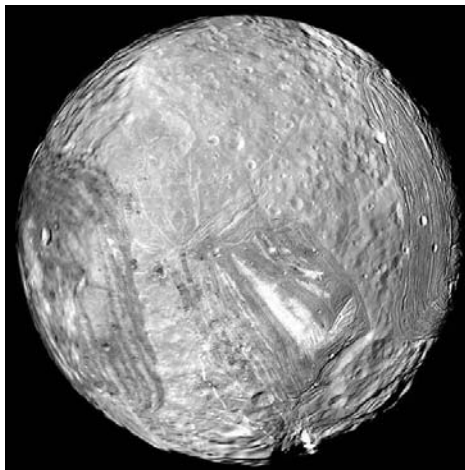
Using the methods used by the unmanned probes sent to fly by the outer planets, for humans the space journey to these planets would take a total of 24 years to complete. The opportunity only comes every 176 years, when the planets are correctly aligned for it. In order to survive in space for this long, the astronauts would need to employ dynamic recycling tactics that include creating freshwater from water used during showers, hand washings, and urine.

The film looked at the problems of this type of trip, drawing on current experiences and experiments with lengthy periods in space. Various ways these problems might be dealt with were also covered, the most controversial being cryo-preservation. This is the low-temperature preservation of humans

with the hope that resuscitation may be possible in the future or in this case, when they arrive at the outer planets. It is called Cryonics (from Greek kryos-meaning icy cold) and is currently available in America for people who can no longer be sustained by contemporary medicine, but hope that healing and resuscitation may be possible in the future, thus giving them a second shot at life.

The film also covered what has been learnt from the two Voyager probes and gave some interesting information on the moons of Uranus and Neptune. Triton, the largest of Neptune's 13 moons, has an opposite rotation pattern and has a rippled surface, giving it the appearance of a cantaloupe. On this moon, there are geysers shooting almost 10 miles into the atmosphere. One of Uranus' 27 moons, Miranda, is only 290 miles across and appears fragmented with cliffs nearly three times higher than America's Grand Canyon.

After the main film, attendees watched the December 2010 Sky at Night show about Supernovas their Light Echoes. Light Echoes are produced when the initial light flash from a Supernova is reflected off intervening interstellar dust and therefore can be seen centuries or millennia later. One example is the SN



The little Moon Miranda taken by the Voyager 2 Spacecraft in 1986



Container used in Arizona for storing frozen preserved deceased human beings for later possible resuscitation!

1572 supernova initially observed on Earth in 1572 by Tycho Brahe, and then in 2008, faint light-echos were seen on dust in the northern part of the Milky Way. Light Echoes allow Astronomers to compare Supernova explosions with their remnants.

Next month's Film Night is on Monday July 18th at 8pm at Stardome. The film is "Journey through the Milky Way".

This 90 minute documentary takes you on the ultimate trip, an imaginary journey through the Milky Way. Made in 2011 it has some great graphics and imagery, mixed with interviews with leading scientists. It also covers some of the latest facts and theories about Dark Matter, other Solar Systems, Black Holes and Star Formation.

Library Corner

With Tony Reynolds

Two New Books of Interest

Naked Eye Wonders

A Short Guide to the Stars as seen from Aotearoa New Zealand

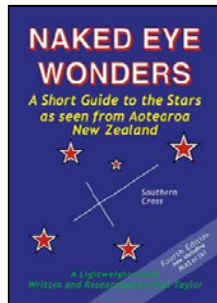
Paul Taylor

A fantastic booklet covering topics such as the constellations, Matariki, dark adaptation, the Moon, planets and the Sun – all with a New Zealand perspective.

Maori astronomy runs throughout.

Paul is a member of this Society.

Catalogue section: QB63



How it Works – Space Exploration

Steve Parker

Discover the inner workings of 15 space craft, from the earliest rockets to the latest probes.

Detailed cutaway illustrations
Exploded views of inner workings
Sketches demonstrate key concepts
Technology clearly explained

Catalogue section: Youth



Featured Section – QB63 Stargazing/QB64 Observer's Guides

One section in two parts really. These two sections contain a wealth of information on practical astronomy and catalogues of interesting objects to work your way through.

Of special interest within QB63 is a collection of New Zealand and Australian guides, providing focused information for southern hemisphere viewing rather than pages upon pages of objects we can't see from here.

Another topic well-covered is binocular viewing, as much as many people ever need.

User's Guide – Borrowing a Book

For new members and anyone not familiar with borrowing books, here's a run-down on how to borrow a book (or magazine, DVD etc).

If any of the librarians are available in the library then we can scan your book directly in to the computer.

Otherwise, check the book out yourself on the form provided and the details will be transferred to the computer at a later date.

The form is on the table near the door and looks like this;

AAS Library		Book Sign-out Form		Librarian Use Only
Member ID Number	OR Member Name			
Book Barcode	AND Book Title			
Member ID Number	OR Member Name			
Book Barcode	AND Book Title			
Member ID	OR			

Locate the AAS Library barcode number of the book you're checking out, usually on the inside front cover for books and directly on the front of magazines.

Fill in the form (except the last column) and you're all done. You only need your member ID or name, the item barcode and item title.

Please note the title alone is not always sufficient to identify the item as we have multiple copies of many. Also, while the barcode is usually sufficient, the title can help the librarian identify the item where some confusion arises.

The lending period is:

Books and DVD's – 4 weeks with renewal on request

Magazines – 2 weeks for recent releases, 4 weeks for older copies. Please note that the recent magazines are very popular so please return them on time or even earlier if possible.

Stardome Talk with Dr Brian Henshall

Title: "The Life of Brian: An optimist looks back on his life" and draws some conclusions as to what matters most from his experiences.

The talk will draw on his 60 years of Aerospace and rocketry experience from the days of Wernher von Braun and William Pickering to today at MOTAT.

Date: **Sunday 7 August 2011**. Admission free

Time: **2:30 - 3:30 pm** Tea and biscuits following talk

Venue: **Auckland Stardome Observatory - One Tree Hill**

MOA Finds Interstellar Planets

from press releases by 'Nature' and The University of Auckland: RASNZ Newsletter

Free-floating planets roaming interstellar space have been discovered by New Zealand and Japanese scientists, through a project co-established by Auckland University physicist Associate Professor Phil Yock. The Jupiter-mass objects are likely to be planets wandering around the Galaxy's core instead of orbiting host stars. Indications are that they might be nearly twice as numerous as the most common stars.

To find the wanderers, scientists turned their telescopes towards the Galactic Bulge surrounding the centre of the Milky Way. Using a technique called gravitational microlensing, they detected 10 Jupiter-mass planets wandering far from light-giving stars. Then they estimated the total number of such rogue planets, based on detection efficiency, microlensing-event probability and the relative rate of lensing caused by stars or planets. They concluded that there could be as many as 400 billion of these wandering planets, far outnumbering main-sequence stars such as our Sun. Their work is published in *Nature* on May 18.

The existence of free-floating planets has been predicted by planetary formation theory, but nobody knew how many there were. Because current theories of planet formation hold that lower-mass planets are more readily flung from developing planetary systems than are higher-mass planets, there could be a huge number of lighter planets on the loose.

Scientists from the Microlensing Observations in Astrophysics (MOA) and Optical Gravitational Lensing Experiment (OGLE) collaborations used gravitational microlensing to detect the planets. Microlensing involves measuring changes in the brightness of distant, background stars as a passing planet's gravity bends and magnifies the starlight. As a result, the star brightens and fades in a pattern distinct from random twinkling, and the duration of brightening indicates the mass of the magnifying object.

Gregory Laughlin, an astronomer at the University of California at Santa Cruz, says the authors have done a good job of ruling out other possible explanations for the light-distorting objects. But he adds that it's difficult to speculate about the number of unbound, lower-mass planets on the basis of the wandering Jupiters, because that assumes that they were formed by a similar mechanism to planets in our neighbourhood. "I think we might be seeing a different formation mechanism here, something more similar to that of a tiny star than a giant planet," he says. "But that's just a hypothesis."

The next steps in the search include confirming the absence of host stars and looking through new data for the footprints of smaller, Saturn- or Neptune-mass planets.

In the future, drifting Earth-mass planets could be detected using NASA's planned Wide-Field Infrared Survey Telescope (WFIRST), a space-based telescope capable of resolving the more rapid bright blips associated with lower-mass objects.

Phil Yock noted that "The work capitalises on New Zealand's southern location. The centre of the galaxy is in the southern sky, and the dense stellar fields there provide frequent examples of the gravitational lensing effect. Since 1994 a number of observations of stars and planets have been made using the effect that could not have been made using conventional astronomical techniques, including detailed measurements of the shapes of distant stars and the discovery of a number of planets orbiting stars beyond their snowlines, where water freezes."



The telescopes at Mt John seen at sunset



The 1.8m MOA telescope at The University of Canterbury's Mt John Observatory is the largest optical telescope in New Zealand and the largest in the world dedicated to searching for microlensing events.

"The discovery of free-floating planets was made primarily by the MOA group but important supporting data were supplied by Polish scientists. The planets were discovered using gravitational lenses of weaker power than normal stellar lenses."

Dr Yock co-founded MOA with Professor Yasushi Muraki of Japan but says that it wouldn't have been possible without Professor John Hearnshaw from Canterbury University lending a telescope at Mt John Observatory for the first 10 years. New Zealand's largest telescope was later installed at the observatory for use by MOA, funded mainly by a grant to Professor Muraki. Many of the New Zealanders involved are Phil Yock's former students including Dr Ian Bond who now leads the New Zealand contribution from Massey University.

The Mystery of Life

By Colin Little

"Oh sweet mystery of life, at last I've found you"

"Now I know the secret of it all"

An old romantic song, charming but quite mistaken. No one, not the song writer nor anyone else, has been able to discover what life actually is or how it was created.

Charles Darwin, who spent his life studying life forms and how they evolved over millions of years, must have spent long hours thinking about this without coming to any conclusion or risking the publication of his thoughts. He delayed writing his book because for thousands of years everyone believed that God had created the Earth and everything in it, including humans, in six days. The Bible said so. Anyone who contended otherwise, even not that long ago, risked being condemned as a heretic and punished by being burnt to death at the stake.

When Darwin did publish "The Origin of Species" there was some outrage. He was abused, criticised and mocked, even though he included the supposition of a super-natural origin of life in the beginning, as shown on the last page of his book, something he added in later additions:

"Variability from the indirect and direct action of the conditions of life, and from use and disuse: a ratio of increase so high as to lead to a struggle for life, and as a consequence to natural selection, entailing divergence of character and the extinction of less improved forms. Thus, from the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows. There is grandeur in this view of life, with its several powers, having been originally breathed by the Creator into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning, endless forms most beautiful and most wonderful have been, and are being, evolved."

End Quote .

Gradually the importance of what Darwin had achieved began to be recognised. Scientists began to think about what life actually was, how life began and whether it could be created.

As technology developed, work at various universities began to try and create life in the laboratory. To make a living cell, the ingredients of such a cell have been identified, created and assembled in the correct proportions without any result, in spite of the detailed work involved. Others have adopted a slightly different approach, assembling the chemicals in sequence, in a manner similar to the mass production of cars. The same negative result - what they made showed no sign of life. Earlier work had been more promising when a mixture of the chemicals, which were probably found in hot pools, were subjected to sparks simulating lightning strikes. Science was excited when amino acids, the precursors of proteins, were found in the mixture. But still there was no sign of life.

In a recent 'scientific' TV programme, the presenter showed what he said was a primeval living cell which had somehow been uniquely created in the distant past and which had divided and multiplied to produce over the millions of years of evolution, all the diverse forms of life including ourselves.

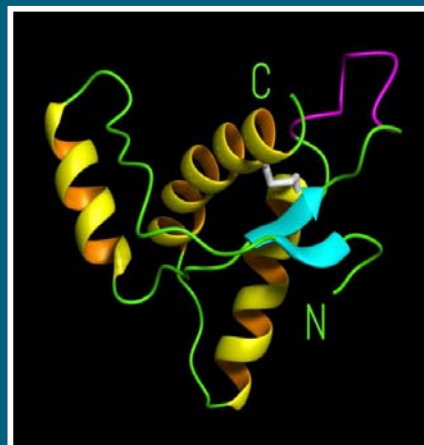
This guess at what happened is naive. If one living cell was created, then millions of others under similar conditions around the world could also have been created, not only on that day but thereafter and for all the millions of years to the present day.

If there are two identical cells, one of which is alive and the other recently dead, it is reasonable to deduce that the living one has something identifiable which the dead one no longer has or which has in some way disintegrated. No such substance has been seen, weighed or otherwise identified, even when large numbers of living and cells have been collectively or singly measured. This does not mean that the missing substance does not exist. It may exist but is so small

as to be beyond modern means of detection.

Perhaps the answer could be that the secret of life may be one or more of the minute imperceptible objects called prions. Prions are similar in a way to viruses but are much smaller, possibly as small as a single molecule. They have been diagnosed by medical science as responsible for several fatal diseases of the brain.

If all magic and possible supernatural explanations are excluded, then life can be assumed to be basically a chemical and/or physical activity. Many chemical reactions will only take place in the



A Prion is an infectious particle made mostly of protein. A prion is a mis-folded form of the PrP protein. Prions do not replicate, they cause other PrP proteins to become mis-folded. Prions cause proteins to form into an amyloid, or a tightly packed beta sheet. These packed beta sheets are extremely dense and very stable. When they accumulate they become extremely resistant to denaturation and chemical treatment. Prions accumulate extracellularly within the central nervous system. Diseases caused by prions are untreatable and fatal. Researchers are scrambling to find answers to the unanswered questions about diseases caused by prions.

From Microscopes Blog.com

presence of another element or compound - a catalytic effect.

So the failures to create life in the laboratory may be due to the absence of a suitable catalyst. That catalyst may be a prion.

There may be one or more types of prion which can activate suitable combinations of chemicals into what we call life. That is the group of chemicals that can be activated to absorb more chemicals into an arrangement which allows them to divide equally into two similar groups and continue the process indefinitely. The prion catalyst can at the same time absorb what it needs so that it can divide and multiply.

Perhaps that successful experiment where mixtures of chemicals were bombarded by electrical discharges, "simulated lightning flashes", which resulted in compounds being formed including amino acids, the precursors of proteins, may be a clue as to how prion catalysts may work in the activation of life in the sea.

The necessary conditions would include a sea containing many chemicals that is breaking on a shore with hot springs, fumaroles, mud pools etc., all contributing to chemical mixtures. These conditions would probably have existed in many locations on the seashore of the early Earth as it cooled from its violent beginnings. It may still happen today but much less frequently.

Various combinations of the chemicals would float away into the sea, perhaps carrying prions which would activate

some of the chemical clusters. How prions formed is open to speculation, but prions do form in some way as is evidenced by those in existence now and which must have evolved over time.

The primordial sea would have been devoid of life and there would be 'floating the early clumps of chemicals of different sizes and different compositions. Larger clumps would bump into and absorb smaller ones. Clumps with catalytic prions would evolve more elaborate clumps which would accumulate non-active ones of all sizes.

Thus a Darwinian evolutionary process would already have begun. Over a long period of time the Clumps would grow bigger and by chance more complex. Over this time, thousands or millions of years this evolution would not have been interfered with by predators because none were present in the early sea. That is until the clumps, having themselves some form of life, became predators as they evolved.

So a form of life slowly formed in many places round the world. Primitive organisms under different climatic conditions gradually evolved primitive plants and animals.

Primitive clumps are most likely still being formed but they do not survive to evolve because of the myriad of competitors and predators which exist today.

Thus it seems reasonable to contend that modern researchers could create extremely simple forms of life in the laboratory if they included a suitable

catalyst. Scaremongers who contend that to do so runs the risk of creating monsters do not realise how slow evolution is and that to hurry it up in the laboratory would require many generations of researchers over thousands of years even to accelerate the evolution of the simplest form of plant or animal.

A graph of the progress of evolution from the simplest cells to modern humans against time would show extremely slowly accelerating progress until Homo Sapiens appeared over the last tens of thousands of years. Then the graph begins to rise exponentially until the evolution of intelligence that eventually results in disastrous damage to the ecosystem from warfare or terrorism, which will eventually result in another massive extinction of species. Then the graph of life will collapse until another slow evolution of species and diversity of life can begin again.

There is no attempt to explain here how the prions, the suggested catalysts of life evolved, except that the early conditions of a warm sterile world provided conditions for many simple and complex chemical and physical conditions to exist, among which primitive life forms could compete and evolve over long periods of time.

Editor's note

Colin has a doctorate in biological sciences and has been a regular science writer for many years. He tells me that he is 97½.

Society Bring & Buy

Bring - Buy - Exchange Day

Sunday 14th August

10am - 2pm at Stardome Observatory

The society is hosting a Bring - Buy - Exchange Garage Sale day in August

A wide range of astronomical items will be available including telescope, telescope parts, accessories and books. Members will also be able to bring their own items to sell.

Full details will be in the August journal.

For more information contact Grant Christie at grant@christie.org.nz or phone 09 636 3437.

Coma Berenice

(Berenice's hair)

By Ivan Vazey



Berenice, the wife of king Ptolemy 3rd of Egypt, was famous for her beauty. Queen Berenice was very proud of her long amber tresses.

At that time the Egyptians and the Seleucids were at war and Berenice, fearing for her King's safety, consulted the royal oracle on what she could do to stave off disaster.

The Oracle told her to cut off her beautiful locks and offer them to Aphrodite (the goddess of love and Beauty) in exchange for the safe return of her husband. Berenice placed her offering on the Altar of Aphrodite and of course, the king returned safely.

Meanwhile her offering had disappeared from the altar and Ptolemy demanded an explanation from Conan, the royal oracle.

Conan waited until nightfall and taking the royal couple outside, showed them the area of sky near Leo saying "Your majesty, the Gods were so impressed with your gesture, they placed your hair in the Heavens to be admired by all."

A lovely lady.. Well actually no. She spent much of her later life poisoning those around her (Literally).

Items to View in this area.

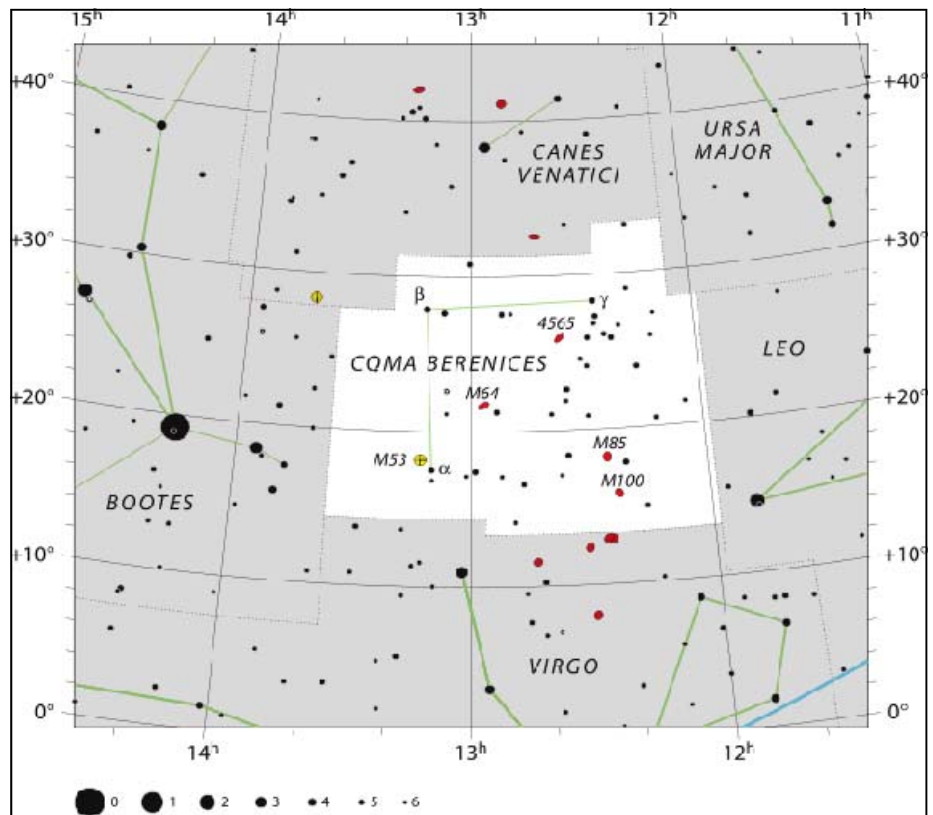
Northern Coma.

NGC 4889 An elliptical galaxy 2.6Deg

M53 - Globular Cluster in Coma Berenices 1

Discovered 1775 by Johann Elert Bode.

Globular star cluster Messier 53 (M53, NGC 5024) is one of the more outlying globulars, being about 60,000 light-years away from the Galactic Centre, and almost the same distance (about 58,000 light-years) from our Solar System. At this distance, its apparent angular diameter of 13' corresponds to a linear diameter of roughly 220 light-years. It is rapidly approaching us at a velocity of 112 km/s, M53 has a bright compact



West of Beta Comae.

NGC4874 another galaxy just to the West

NGC4921 another slightly to the Southeast

NGC4911 just below and to the right. All these are in a close area.

NMGC4725 is a barred spiral 5deg WSW of Beta Comae

Eastern Coma

M53 and M64

Southern Coma

M85, M88, M91, M99 and M100 a beautiful spiral galaxy which has majestic spiral arms. Visible easily through a 6inch scope but best through Hubble.

central nucleus of about 2' in diameter.

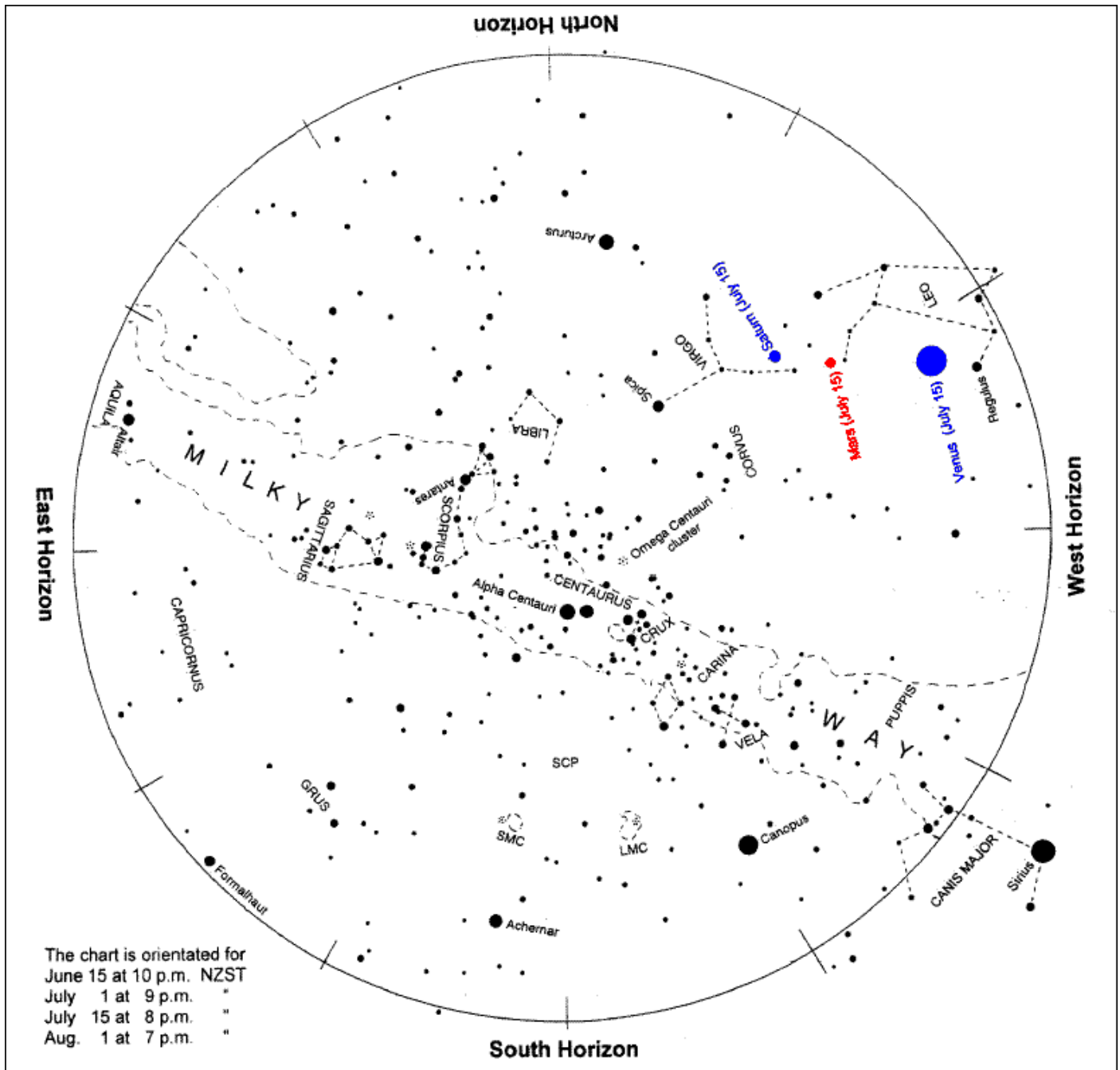
As in all globular clusters, the stars of M53 are apparently "metal-poor", which means that they contain only little quantities of elements heavier than helium (actually mainly elements like carbon and oxygen); those of M53 are even below the average globular cluster members in "metallicity". It contains the considerably respectable number of 47 known RR Lyrae variables, some of them were reported to have changed their periods irreversibly with time .



The Globular Cluster M53 in Coma Berenice. M53 is a classical low metallicity cluster, meaning that it contains mostly stars that were probably formed from the primordial gas cloud.

The Night Sky in July

From the RASNZ Website



To use the chart, hold it up to the sky. Turn the chart so the direction you are looking is at the bottom of the chart. If you are looking to the south then have 'South horizon' at the lower edge. As the Earth turns, the sky appears to rotate clockwise around the south celestial pole (SCP on the chart). Stars rise in the east and set in the west, just like the Sun. The sky makes a small extra rotation from night to night as we orbit the Sun.

Venus is the brilliant 'evening star'. It is seen in the northwest at sunset and sets mid-evening. Mars and Saturn are above Venus.

At the end of the month Mercury appears below Venus. Sirius, the brightest real star, sets in the southwestern twilight. Canopus, the second brightest star, is low in the southwest and swings down to the southern horizon later. The Pointers and Crux, the Southern Cross, are south of the zenith. Orange Arcturus in the north often twinkles red and green. The Scorpion is on its back high up the eastern sky with Sagittarius below it. Jupiter (not shown) rises in the east about 11 pm .

Chart produced by Guide 8 software; www.projectpluto.com. Labels and text added by Alan Gilmore, Mt John Observatory of the University of Canterbury. www.canterbury.ac.nz

Observing Notes July 2011

By Alan Gilmore

Sirius, the brightest star, sets in the southwest in early twilight, twinkling like a diamond. Canopus, the second brightest star, is also in the southwest at dusk. It swings south later. Mercury is in the western sky at dusk, setting after 7:00pm mid-month. South of the zenith are 'The Pointers', Beta and Alpha Centauri. They point to Crux, the Southern Cross, on their right. Left of the Pointers, along the Milky Way, is orange Antares, the brightest star in Scorpius. Midway up the northern sky is a brighter orange star, Arcturus. Above and left of Arcturus is Saturn with similar-looking Spica above it.

Mercury remains in the western sky all month as it swings out from the far side of the Sun and catches us up. It is at its greatest angle from the Sun around July 20. Then it is setting around 7:30. Being just one-third the diameter of Earth, Mercury is always small in a telescope. At the beginning of July it looks like a tiny gibbous Moon. It is then 170 million km away. By the end of the month it is closer, around 100 million km away, but most of the sunlit side will be turned away from us, leaving a tiny crescent. Mercury orbits the Sun at one-third our distance, so moves much faster than Earth. It laps us every 116 days.

A small telescope will show Saturn's rings and biggest moon Titan about four ring-diameters from the planet. Other smaller moons appear as faint stars closer to Saturn. Saturn is around 1,470 million km away in July. Signals from the Cassini spacecraft orbiting Saturn take 80 minutes to reach us.

Alpha Centauri is the third brightest star. It is also the closest of the naked eye stars, 4.3 light-years away. It is a binary star: two Sun-like stars orbiting each other in 80 years. A telescope magnifying 50x will split the pair. Beta Centauri, like most of the stars in Crux, is a blue-giant star hundreds of light-years* away.

Canopus swings down to the southern skyline before midnight then moves into the southeast sky in the morning hours. Canopus is a truly bright star: 13,000 times the Sun's brightness and 300 light-years away.

Arcturus, in the north, is the fourth brightest star and the brightest in the northern hemisphere sky. It is 120 times the Sun's brightness and 37 light years away. When low in the northwest around midnight Arcturus twinkles red and green.

East of the zenith is the orange star Antares, marking the heart of the Scorpion. The Scorpion's tail, upside down, is stretched out to the right of Antares making the 'fish-hook of Maui' in Maori star lore. Antares is a red giant star: 600 light-years away and 19,000 times brighter than the Sun. Below Scorpius is 'the teapot' made by the brightest stars of Sagittarius. It is also upside down in our southern hemisphere view.

The Milky Way is brightest and broadest in the east toward Scorpius and Sagittarius. In a dark sky it can be traced up past the Pointers and Crux, fading toward Sirius. The Milky Way is our edgewise view of the galaxy, the pancake of billions of stars of which the Sun is just one. The thick hub of the galaxy, 30,000

light years away, is in Sagittarius. The actual centre is hidden by dust clouds in space. A scan along the Milky-Way with binoculars shows many clusters of stars and some glowing gas clouds.

The Large and Small Clouds of Magellan, LMC and SMC, look like two misty patches of light low in the southern sky. They are easily seen by eye on a dark moonless night. They are galaxies like our Milky Way but much smaller. The large cloud is 160,000 light-years away; the small one 200,000 light-years.

Jupiter (not shown) rises in the eastern sky after 1:00a.m. It is the brightest 'star' in the late night sky and shines with a steady golden light. By dawn it is midway up the north sky. Binoculars show the disk of Jupiter and perhaps one or two of its bright moons. A small telescope easily shows all four moons and stripes in Jupiter's clouds. Mars rises in the northwest about 6:00a.m. appearing below Aldebaran, a star of similar brightness and orange colour. Brilliant Venus might be glimpsed low in the bright dawn twilight.

*A light year (l.y.) is the distance that light travels in one year: nearly 10 million million km or 10^{13} km. Sunlight takes eight minutes to get here; moonlight about one second. Sunlight reaches Neptune, the outermost major planet, in four hours. It takes four years to reach the nearest star, Alpha Centauri.

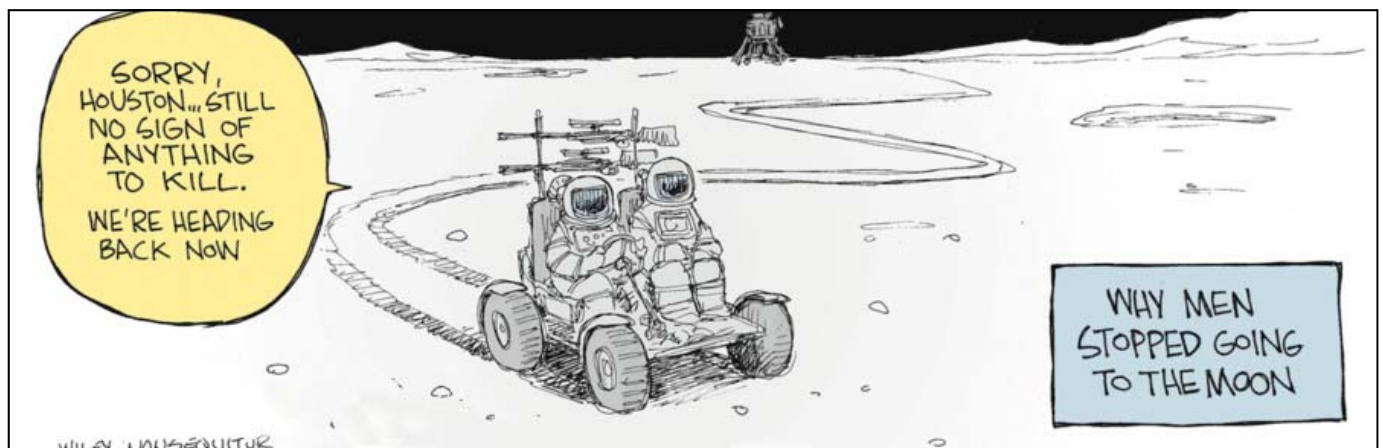
Notes by Alan Gilmore, University of Canterbury's Mt John Observatory, P.O. Box 56, Lake Tekapo 7945, New Zealand.

www.canterbury.ac.nz

Diary of Solar System Events for July 2011

From the RASNZ Website

July 1	New Moon at 8.54pm NZST (08:54UT). Partial eclipse of sun visible only from ocean to south of South Africa.
July 3	4% lit crescent moon 5° above Mercury, early evening sky.
July 4	Earth at aphelion, greatest distance from the sun for the year, 152.1 million km, 1.0167 Astronomical Units.
July 5	17% lit moon 5.2° above Regulus, Leo, magnitude 1.4, evening sky.
July 5/6	Mars, magnitude 1.4, 5.4• from Aldebaran, magnitude 1.1, early dawn sky.
July 8	Moon at perigee, its closest to the Earth for the lunar month, 369567 km.
July 8	Moon at first quarter at 6.29pm NZST (06:29 UT).
July 8	51% lit Moon 9° from Saturn, and 7.5° to lower left of Spica, Virginis, magnitude 1.1, evening sky.
July 9	62% lit Moon 9° to upper left of Spica.
July 10	Uranus stationary.
July 12	90% lit Moon 5° below Antares, Scorpii, magnitude 1.1, evening sky.
July 12	Neptune completes its first orbit of the Sun since discovery in September 1846.
July 13	Moon furthest south, so highest southern hemisphere transit for the month.
July 15	Full Moon at 6.40pm NZST (06:40UT).
July 20	Mercury at greatest elongation 27° east of sun.
July 21	72% lit moon 7.5° below Uranus, magnitude 5.8, pre-dawn sky.
July 22	Moon at apogee, its greatest distance from the Earth for the Lunar month, 404358 km.
July 23	Moon at last quarter 5.02pm NZST (05:02 UT).
July 24	44% lit Moon 6° below Jupiter, morning sky.
July 25-28	Mercury, magnitude 0.8, less than 3° to left of Regulus, Leo, magnitude 1.4, early evening sky.
July 27	Moon furthest north, so lowest southern hemisphere transit for the month.
July 28	10% lit crescent moon 1.5° to lower right of Mars, magnitude 1.4, early dawn sky.
July 31	New Moon at 6.40am NZST (Jul 30, 18:40T).



Earth-Companion Asteroid Discovered in Horseshoe-Shaped Orbit

From Technology Review

In the 1969 film *Doppelganger*, scientists discover and then visit an Earth-like planet sharing our orbit but on exactly the other side of the Sun.

Since then, astronomers have ruled out the possibility of such a planet on the grounds that its gravitational effects on other planets and spacecraft would be easy to see.

But that doesn't rule out the possibility of smaller objects sharing Earth's orbit and today, Apostolos Christou and David Asher at the Armagh Observatory in Northern Ireland say they've found one--an asteroid called 2010 SO16.

Near-Earth asteroids are common but SO16 is in a category of its own. First and foremost, it has an exotic horseshoe-shaped orbit (see diagram above) which astronomers believe to be very rare.

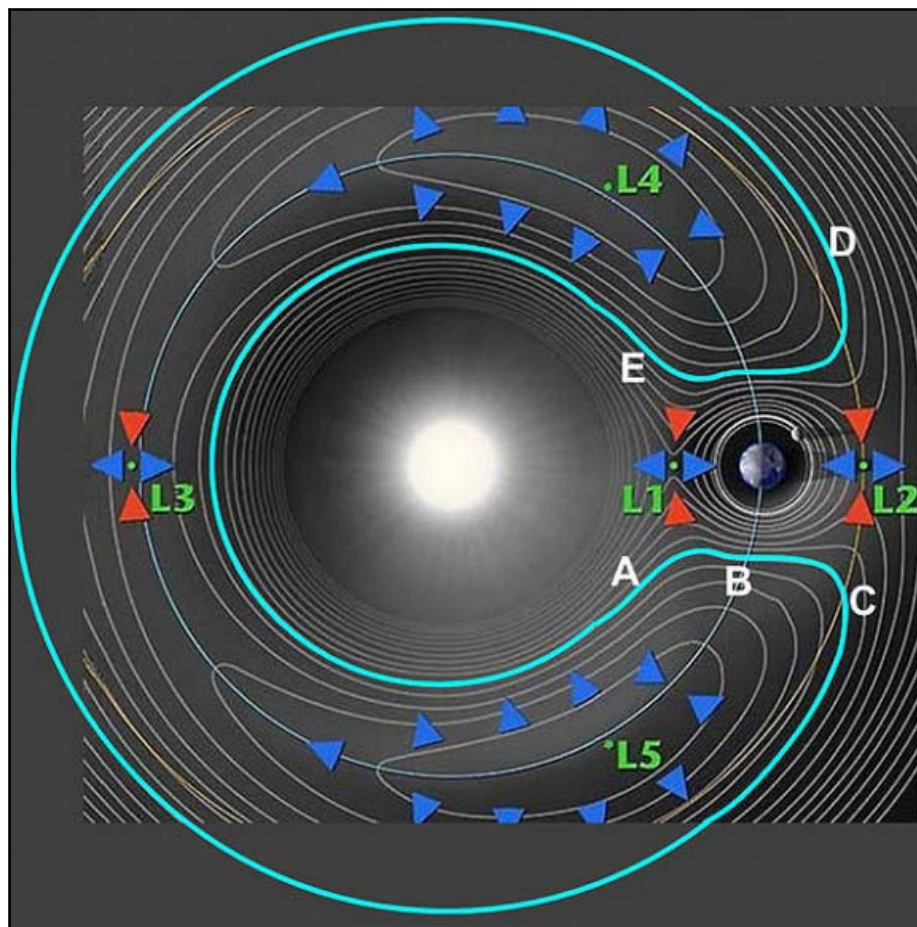
Its worth taking a few moments to think about horseshoe orbits. Two points are worth bearing in mind. First, objects further from the Sun than Earth orbit more slowly. Second, objects that are closer to the Sun orbit more quickly than Earth.

So imagine an asteroid with an orbit around the Sun that is just a little bit smaller than Earth's. Because it is orbiting more quickly, this asteroid will gradually catch up with Earth.

When it approaches Earth, the larger planet's gravity will tend to pull the asteroid towards it and away from the Sun. This makes the asteroid orbit more slowly and if the asteroid ends up in a orbit that is slightly bigger than Earth's, it will orbit the Sun more slowly than Earth and fall behind.

After that, the Earth will catch up with the slower asteroid in the bigger orbit, pulling it back into the small faster orbit and the process begins again.

So from the point of view of the Earth, the asteroid has a horseshoe-shaped orbit, constantly moving towards and



In this graphic of a horseshoe orbit from NASA, Horseshoe orbits follow contour lines that enclose Lagrange points L3, L4 & L5. Credit: NASA

away from the Earth without ever passing it. (However, from the asteroid's point of view, it orbits the Sun continuously in the same direction, sometimes more quickly in smaller orbits and sometimes more slowly in bigger orbits.)

For SO16, the period of this effect is about 350 years

Horseshoe orbits are thought to be very unstable, since any small gravitational tug can destroy the fragile resonance that has been set up. However, SO16's orbit is surprisingly robust.

Christou and Asher simulated its orbit with slightly different values for parameters such as its semi-major axis. In these simulations, SO16 remained in a horseshoe-shaped orbit for at least

120,000 years and sometimes for more than a million years.

Astronomers know of three other horseshoe companions for Earth but these are all much smaller (SO16 is a few hundred metres across) and none have orbits that are likely to survive for more than a few thousand years.

That makes SO16 kind of special. For anybody willing and able to look, it is currently near one of its points of closest approach, with an absolute magnitude of about 20, lagging the Earth by 0.13 AU, like a stray puppy.

And it will be there for some time, say Christou and Asher. "It will remain as an evening object in the sky for several decades to come."

The Milky Way's New Arm

From Skyandtelescope

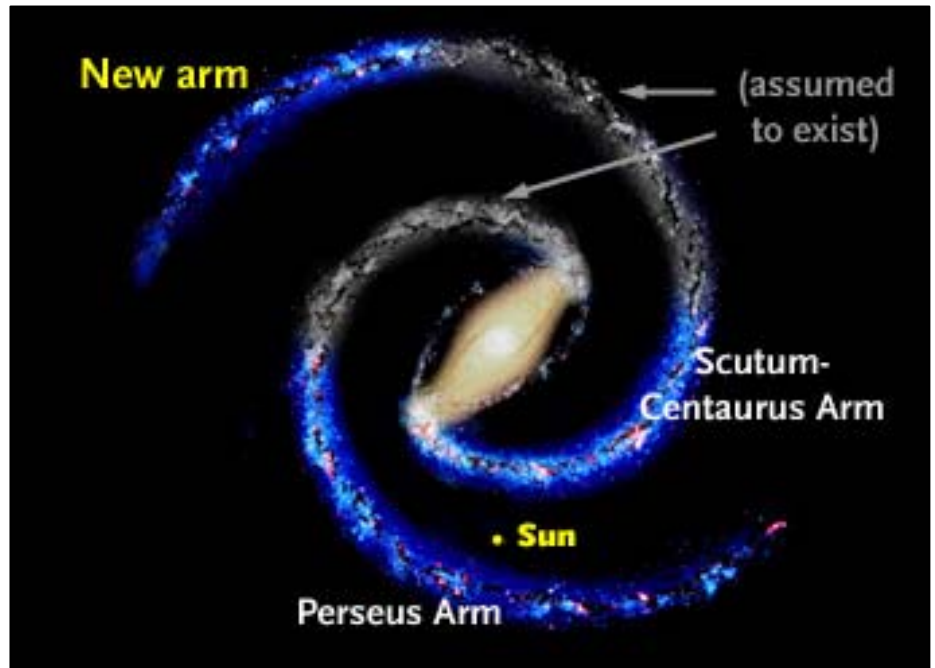
This might come as a surprise, but every portrayal ever made of how the Milky Way Galaxy looks from afar is more imagined than factual. That's because we sit squarely inside our galaxy's turgid disk, which together with its bloated central bulge, makes it impossible to see most of what lies on the side opposite the Sun. We're only getting half the picture.

Astronomers have certainly tried to piece together the true shape of its spiral. "For years, people created maps of the whole galaxy based on studying just one section of it, or using only one method," says Robert Benjamin (University of Wisconsin). "Unfortunately, when the models from various groups were compared, they didn't always agree."

A few years ago, Thomas Dame, Benjamin and others used NASA's Spitzer Space Telescope to deduce that our galaxy really has just two main spiral arms, not four as had been thought. Called the Scutum-Centaurus and Perseus arms, these appear to connect up nicely with the ends of the galaxy's central bar. (Our Sun lies along a minor offshoot, about halfway from the centre to the outer edge, known as the Orion Spur).

But there's been little hard evidence to prove that the galaxy's majestically sweeping arms continue around to its far side, until now. As Thomas Dame (Harvard-Smithsonian Center for Astrophysics, CFA) described this week at a meeting of the American Astronomical Society, he and CFA colleague, Patrick Thaddeus, have identified a distant arm on the disk's outer margin, on the far side, that's roughly 50,000 light-years from its centre.

They detected the arm's presence, not with some enormous globe-spanning array of radio telescopes, but instead with a very modest 4-foot (1.2-m) dish



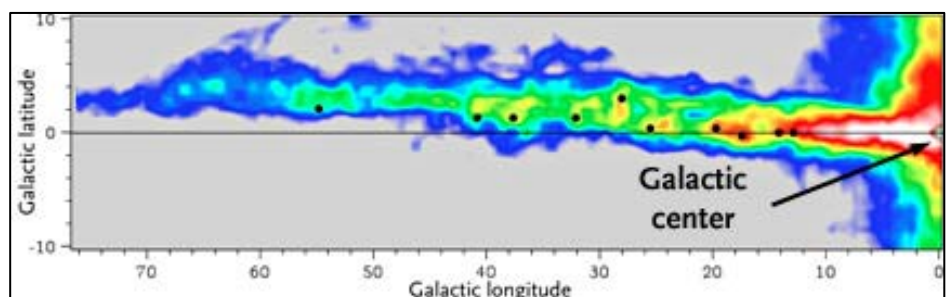
The Milky Way's basic structure involves two large spiral arms believed to originate at either end of an elongated central bar. But only parts of the arms can be seen — grey segments indicate portions not yet detected.

atop one of the CFA's buildings in Cambridge, Massachusetts. The telescope was tuned to the 115-gigahertz emission of carbon monoxide (CO) in giant molecular clouds and then pointed at hundreds of target fields near the galactic plane.

The telltale carbon-monoxide emission turned up in a string of 10 locations, hardly a comprehensive sampling, but enough to sketch in the distant arm's location and extent. One of the CO-rich clouds turns out to be about 150

light-years across and has a mass of at least 50,000 Suns.

The arm also shows up in prior radio surveys that mapped the abundance of neutral hydrogen throughout the disk. It largely escaped detection, Dame speculates, because it's both displaced from the galactic plane and tilted with respect to it. Also, Dame adds, "The main problem with hydrogen is that there is too much of it." In any case, the CO radio hits match strongest hydrogen concentrations along the distant arm,



This colour-coded plot of radio emission from neutral hydrogen traces out a long portion of a spiral arm located on the far side of our galaxy. Black dots indicate where radio astronomers detected strong emissions from carbon monoxide in giant molecular clouds along the arm.



This modest rooftop radio dish, only 4 feet (1.2 m) across, has mapped the presence of carbon monoxide in giant clouds throughout the galaxy.

assuring that it's real.

The new find is an isolated segment that's roughly 60,000 light-years long. Dame and Thaddeus believe it marks the distant end of the Scutum-Centaurus arm, which would mean that the entire arc is more than 200,000 light-years long and that it wraps more than 300° around the galactic centre.

The two researchers published their results in the May 10th issue of *Astrophysical Journal Letters*. To know

for certain that the new arm is really an extension of the Scutum-Centaurus Arm, they hope to use their little radio dish to map it more completely in the years ahead.

Even if they don't, or can't, it's reassuring to know that the Milky Way really does have the gracefully sweeping arms and beautiful symmetry that befits a grand spiral galaxy.

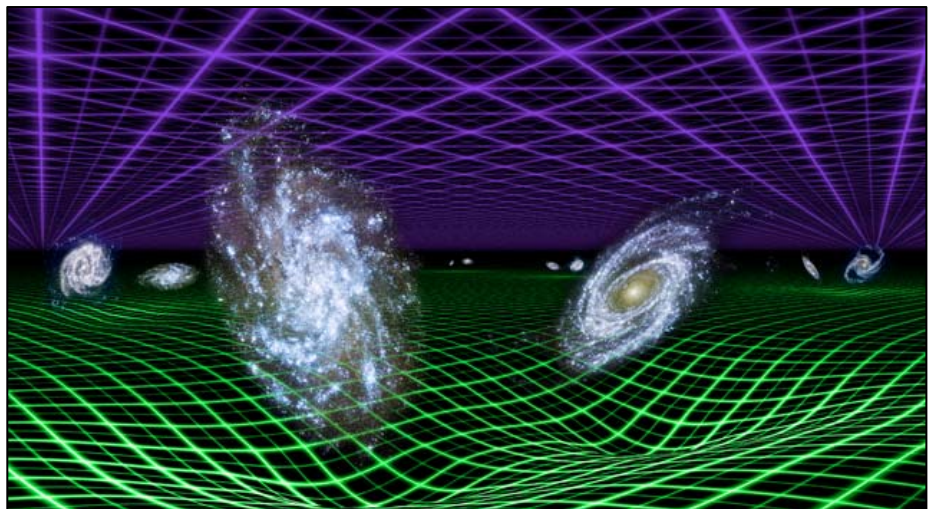
NASA Telescope Helps Confirm Nature of Dark Energy

From NASA

PASADENA, Calif. -- A five-year survey of 200,000 galaxies, stretching back seven billion years in cosmic time, has led to one of the best independent confirmations that dark energy is driving our universe apart at accelerating speeds. The survey used data from NASA's space-based Galaxy Evolution Explorer and the Anglo-Australian Telescope on Siding Spring Mountain in Australia.

The findings offer new support for the favoured theory of how dark energy works -- as a constant force, uniformly affecting the universe and propelling its runaway expansion. They contradict an alternate theory, where gravity, not dark energy, is the force pushing space apart. According to this alternate theory, with which the new survey results are not consistent, Albert Einstein's concept of gravity is wrong, and gravity becomes repulsive instead of attractive when acting at great distances.

"The action of dark energy is as if you threw a ball up in the air, and it kept speeding upward into the sky faster and faster," said Chris Blake of the Swinburne University of Technology in Melbourne, Australia. Blake is lead author of two papers describing the results that appeared in recent issues of the *Monthly Notices of the Royal Astronomical Society*. "The results tell us that dark energy is a cosmological constant, as Einstein proposed. If gravity were the culprit, then we wouldn't be



Dark Energy and Gravity: Yin and Yang of the Universe (Artist's Concept)

Astronomers think that the expansion of the universe is regulated by both the force of gravity, which acts to slow it down, and a mysterious dark energy, which pushes matter and space apart. In fact, dark energy is thought to be pushing the cosmos apart at faster and faster speeds, causing our universe's expansion to accelerate.

In this artist's conception, dark energy is represented by the purple grid above, and gravity by the green grid below. Gravity emanates from all matter in the universe, but its effects are localized and drop off quickly over large distances.

New results from NASA's Galaxy Evolution Explorer and the Anglo-Australian Telescope atop Siding Spring Mountain in Australia confirm that dark energy is a smooth, uniform force that now dominates over the effects of gravity. The observations follow from careful measurements of the separations between pairs of galaxies (examples of such pairs are illustrated here). The results are one of the best confirmations of the nature of dark energy to date.

The California Institute of Technology in Pasadena leads the Galaxy Evolution Explorer mission and is responsible for science operations and data analysis. NASA's Jet Propulsion Laboratory, also in Pasadena, manages the mission and built the science instrument. The mission was developed under NASA's Explorers Program managed by the Goddard Space Flight Center, Greenbelt, Md. Researchers sponsored by Yonsei University in South Korea and the Centre National d'Etudes Spatiales (CNES) in France collaborated on this mission.

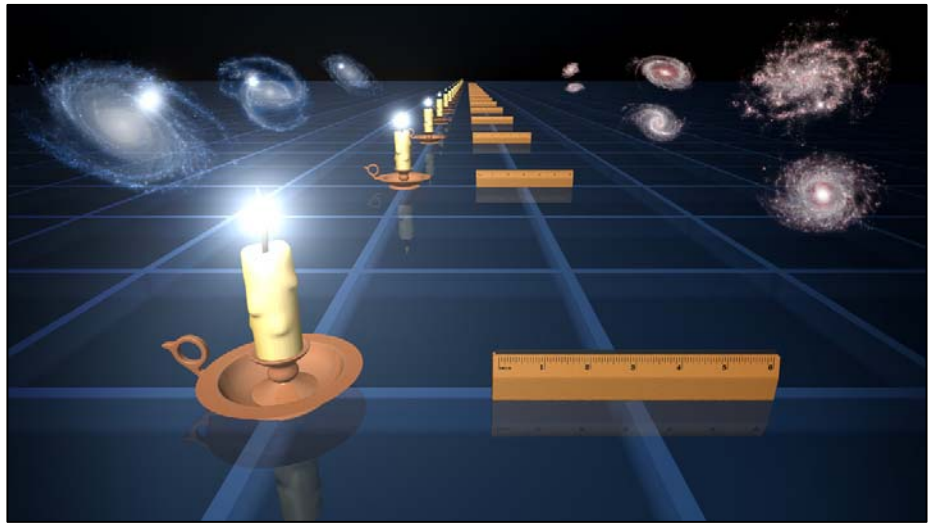
seeing these constant effects of dark energy throughout time."

Dark energy is thought to dominate our universe, making up about 74 percent of it. Dark matter, a slightly less mysterious substance, accounts for 22 percent. So-called normal matter, anything with atoms, or the stuff that makes up living creatures, planets and stars, is only approximately four percent of the cosmos.

The idea of dark energy was proposed during the previous decade, based on studies of distant exploding stars called supernovae. Supernovae emit constant, measurable light, making them so-called "standard candles," which allows calculation of their distance from Earth. Observations revealed dark energy was flinging the objects out at accelerating speeds.

Dark energy is in a tug-of-war contest with gravity. In the early Universe, gravity took the lead, dominating dark energy. At about 8 billion years after the Big Bang, as space expanded and matter became diluted, gravitational attractions weakened and dark energy gained the upper hand. Billions of years from now, dark energy will be even more dominant. Astronomers predict our Universe will be a cosmic wasteland, with galaxies spread apart so far that any intelligent beings living inside them wouldn't be able to see other galaxies.

The new survey provides two separate methods for independently checking the supernovae results. This is the first time astronomers performed these checks



This diagram illustrates two ways to measure how fast the universe is expanding. In the past, distant supernovae, or exploded stars, have been used as "standard candles" to measure distances in the Universe, and to determine that its expansion is actually speeding up. The supernovae glow with the same intrinsic brightness, so by measuring how bright they appear on the sky, astronomers can tell how far away they are. This is similar to a standard candle appearing fainter at greater distances (left-hand illustration).

In a new survey from NASA's Galaxy Evolution Explorer and the Anglo-Australian Telescope atop Siding Spring Mountain in Australia, the distances to galaxies were measured using a "standard ruler" (right-hand illustration). This method is based on the preference for pairs of galaxies to be separated by a distance of 490 million light-years today. The separation appears to get smaller as the galaxies move farther away, just like a ruler of fixed length (right-hand illustration).

The California Institute of Technology in Pasadena leads the Galaxy Evolution Explorer mission and is responsible for science operations and data analysis. NASA's Jet Propulsion Laboratory, also in Pasadena, manages the mission and built the science instrument. The mission was developed under NASA's Explorers Program managed by the Goddard Space Flight Center, Greenbelt, Md. Researchers sponsored by Yonsei University in South Korea and the Centre National d'Etudes Spatiales (CNES) in France collaborated on this mission.

across the whole cosmic time span dominated by dark energy. The team began by assembling the largest three-dimensional map of galaxies in the distant universe, spotted by the Galaxy

Evolution Explorer. The ultraviolet-sensing telescope has scanned about three-quarters of the sky, observing hundreds of millions of galaxies.

The 2011 Council

President	Grant Christie	(021) 024-04992
Vice President	David Britten	(09) 846-3657
Treasurer & Membership	Andrew Buckingham	(09) 473-5877
Secretary	Kleo Zois	022 6912 055
Curator of Instruments	Ivan Vazey	(09) 535-3987
Librarian	Tony Reynolds	(09) 480 8607
Journal Editors	Clive Bolt	(09) 534-2946
	Shaun Fletcher	(09) 480-5648
Webmaster	Nick Moore	(09) 537-1500
Council	Gavin Logan	(09) 820-6001
Council	Bernie Brenner	(09) 445-3293

Society Contacts

Auckland Astronomical Society Inc,

P O Box 24-187, Royal Oak,
Auckland 1345, New Zealand

Email info@astronomy.org.nz

Journal journal@astronomy.org.nz

Website www.astronomy.org.nz

Membership inquiries contact Andrew Buckingham at treasurer@astronomy.org.nz or by phone on (09)-473-5877 or by mobile on 027-246-2446

"The Galaxy Evolution Explorer helped identify bright, young galaxies, which are ideal for this type of study," said Christopher Martin, principal investigator for the mission at the California Institute of Technology in Pasadena. "It provided the scaffolding for this enormous 3-D map."

The astronomers acquired detailed information about the light for each galaxy using the Anglo-Australian Telescope and studied the pattern of distance between them. Sound waves from the very early universe left imprints in the patterns of galaxies, causing pairs of galaxies to be separated by approximately 500 million light-years.

This "standard ruler" was used to determine the distance from the galaxy pairs to Earth -- the closer a galaxy pair is to us, the farther apart the galaxies will appear from each other on the sky. As with the supernovae studies, this

distance data were combined with information about the speeds at which the pairs are moving away from us, revealing, yet again, the fabric of space is stretching apart faster and faster.

The team also used the galaxy map to study how clusters of galaxies grow over time like cities, eventually containing many thousands of galaxies. The clusters attract new galaxies through gravity, but dark energy tugs the clusters apart. It slows down the process, allowing scientists to measure dark energy's repulsive force.

"Observations by astronomers over the last 15 years have produced one of the most startling discoveries in physical science; the expansion of the universe, triggered by the Big Bang, is speeding up," said Jon Morse, astrophysics division director at NASA Headquarters in Washington. "Using entirely independent methods, data from the

Galaxy Evolution Explorer have helped increase our confidence in the existence of dark energy."

Caltech leads the Galaxy Evolution Explorer mission and is responsible for science operations and data analysis. NASA's Jet Propulsion Laboratory in Pasadena, manages the mission and built the science instrument. The mission was developed under NASA's Explorers Program managed by the Goddard Space Flight Center, Greenbelt, Md. Researchers sponsored by Yonsei University in South Korea and the Centre National d'Etudes Spatiales (CNES) in France collaborated on this mission. Caltech manages JPL for NASA.

Graphics and additional information about the Galaxy Evolution Explorer are online at <http://www.nasa.gov/galex> and <http://www.galex.caltech.edu>.

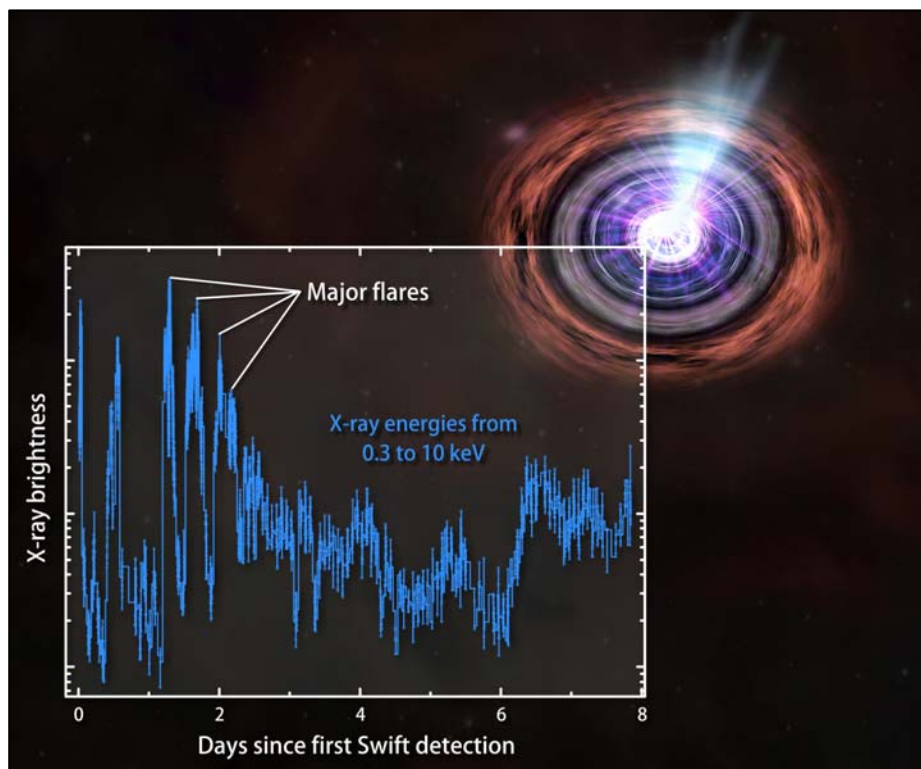
New Discoveries On Odd Stellar Explosions

By Kurtis Williams, Professor Astronomy

Over the last month or so, there have been a couple of news releases about stellar explosions. In the first story, astronomers have spotted a puzzling blast of gamma ray and X-ray emission that could be a star being ripped apart by a massive black hole. In the other story, astronomers have made substantial progress in understanding the brightest supernovae ever observed.

First, the puzzling gamma rays. For decades, astronomers have seen sudden, short bursts of gamma rays coming from all over the sky. About ten years ago, after a lot of hard work (and a little luck) by many different researchers, most astronomers came to believe that many of these "gamma-ray bursts" are the birthing cry of new black holes formed at the centres of massive, exploding stars.

Several space missions have been studying these gamma-ray bursts, including the currently-operating Swift satellite. These satellites automatically detect the few-second long burst of gamma rays, locate where in the sky



they are coming from, and send emails and instant messages to astronomers around the globe alerting them to the event. Especially interesting events can

get rapid observations from large telescopes and major satellites such as the Chandra X-ray Observatory and the Hubble Space Telescope.

On March 28, the Swift satellite detected a burst of gamma rays in the direction of the constellation Draco. Since gamma-ray bursts are seen every few days, this burst started the normal response. Automated messages went out, a team analysed the data and put out some standard preliminary analysis. But just 43 minutes later, Swift detected another burst at exactly the same place. This is very rare, though not unheard of - but it is rare enough that additional resources started swinging into action. Over the next few days, many additional bursts of both gamma rays and X-rays were seen coming from the same object.

Finally, data from the Chandra X-ray Observatory and the Hubble Space Telescope came in. The source of the gamma rays and X-rays lies very close to the centre of an otherwise normal-looking galaxy. In fact, as far as astronomers can tell, the source lies directly in the centre of that galaxy. This discovery, that the weird source lies at the centre of a galaxy, casts suspicion squarely on the type of object that lives in the centre of most galaxies: a super-massive black hole. Now unlike what many people think, a black hole is not some sort of cosmic vacuum cleaner, sucking in everything around it. A black hole can only eat anything that wanders too close.

How close is too close? The diameter of a black hole can be found by multiplying its mass (in terms of the Sun's mass) by 3.7 miles. So, if the Sun were to collapse into a black hole, the black hole would be 3.7 miles across. Typical black holes that form from dying stars are about 10 times the mass of the Sun, and so are a few dozen miles in diameter. The black hole at the centre of our Milky Way galaxy is about 4 million times the mass of the Sun, and so it is about 15 million miles in diameter.

The really weird stuff that happens around black holes due to Einstein's general relativity (time slowing way down, space highly distorted, light being highly bent, and unfortunate space explorers being turned into spaghetti) only happens when you get closer than a few times this distance. So, if the Sun were to be magically transformed into a black hole, really weird things would only happen if you happened to get within a dozen miles

or so of the black hole. The Earth, 93 million miles away, would be unharmed.

The black holes at the centres of galaxies are much larger, but compared to the distances between stars, they are still tiny. The black hole at the centre of the Milky Way has many stars orbiting it, including one star that gets within 10 billion miles (about three times the average Sun-Pluto distance) every 16 years. That star passed by the black hole in 2002 with no ill effects.

Still, if a star were to somehow wander within a hundred million miles or so of a super-massive black hole in the centre of a galaxy, it would get ripped to shreds. This shredding would release a lot of energy in the form of gamma rays and X-rays. A press release from NASA suggests that this is precisely what caused the multiple gamma ray bursts from the otherwise normal galaxy in Draco last week.

This explanation makes sense, but it's important to emphasize that it is just a hypothesis right now. More data continues to come in, and as news of the discovery spreads, more astronomers will begin to compare these data to simulations of what happens when a star is shredded by a black hole. Perhaps they will agree, and perhaps they won't. Time will tell. This leads us to the second story, which was announced this week by McDonald Observatory. This story is based on a journal article that has been published in the *Astrophysical Journal*, one of the main astronomy journals, so the science has already passed significant vetting by peer reviewers. It doesn't mean the science is absolutely, positively right, but it does mean the science has met some substantial level of quality control.

About four years ago, astronomers announced the discovery of what was then the most energetic supernova ever detected. The initial discovery was made by Robert Quimby, then a graduate student at the University of Texas in Austin, and now a postdoctoral researcher at Caltech.

Many people initially speculated that this supernovae, and a few others like it, was a new kind of exploding star. Some models of really massive stars suggest that, as the star ages, it becomes unstable, manages to

create large amounts of antimatter, and rips itself apart in the ensuing explosion, called a pair instability supernova.

However, new studies by Emmanouil "Manos" Chatzopoulos, a graduate student at the University of Texas at Austin, and his advisor, Dr. Craig Wheeler, seem to show that these very luminous explosions are not a pair instability supernova. The stars are, alas, not being torn asunder by the explosive mixture of matter and antimatter. Instead, the evidence suggests that these are normal supernova explosions, but as the blast wave from the star travels outwards at high speeds, it rams into shells of matter thrown off by the star decades or centuries before the supernova. This violent collision releases tremendous amounts of energy in the form of visible light, and makes the supernova appear much more luminous than it otherwise would.

These shells of matter are known to exist around a type of star called a Luminous Blue Variable (LBV). These stars sometimes shed huge amounts of material into space via dramatic eruptions from the surface of the star. In our own Milky Way, the LBV Eta Carinae had just such an eruption back in the 1840s. The Hubble Space Telescope has taken amazing images of the material blown off the star during that eruption.

If Eta Carina were to explode as a supernova now (and it almost certainly will explode within the next million years), the blast wave from the supernova would smash into those large lobes of material, brightening in a very similar way to the very luminous supernovae Manos has been studying.

So, it looks as if Manos's work may have changed the explanation of these ultra-bright supernovae from some exciting and exotic antimatter-driven explosion mechanism to a slightly more mundane "giant outer space train wreck" explanation. But this is so often how science works, and how it should work: explanations for observed phenomena must be tested, re-tested, and then scrutinized some more. Only then can we be reasonably sure we understand what is happening in the depths of space.

★ ★ ★ ASTRONZ

EYEPIECES



Plossl

1.25" - 4, 6, 9, 12, 15, 20, 25, 32 & 40mm

Kellner

2" - 26mm, 32mm & 40mm

SuperView Wide Angle

1.25" - 15mm & 20mm 2" - 30mm, 42mm & 50mm

Camera Projection

1.25" - 32mm & 40mm 2" - 30mm, 42mm



BARLOW LENSES

2x Standard • 3x ED • 2.5x 3-element • 5x 3-element

www.astronomy.co.nz

email: sales@astronomy.co.nz • ph 09 473 5877 • 027 246 2446

QUALITY TELESCOPES...

...at a
great
price

Dobsonian
Telescopes



High Grade
Ritchey-Chretien
Telescopes



*Astrophotographer's
Dream
Machine*



- True Ritchey-Chretien Cassegrain-type optics. Hyperbolic quartz primary and secondary mirrors with 99% reflectivity dielectric coatings
- Carbon-fibre optical tubes - for outstanding thermal stability!
- Ideal for astrophotography - due to their virtually coma-free imaging!
- Flatter image compared to SCT and applanatic/corrected SCT designs

Plossl Eyepieces • SuperView Wide Angle Eyepieces
Camera Projection Eyepieces • Barlow Lenses
Crayford Focusers • Diagonals
Adapters • Filters • Telescope Parts



★ ★ ★ ASTRONZ

www.astronomy.co.nz

ph: 027 246 2446 • email: sales@astronomy.co.nz
Astronomy NZ Ltd • PO Box 39496, Howick, Auckland 2145