AUCKLAND ASTRONOMICAL SOCIETY

April 2011

SOCIETY JOURNAL

Society Meeting - The Kumeu Observatory Take 2

Monday 11th April 8:00pm with Dave Moorhouse

The Kumeu Observatory with the Celestron C14 telescope (inset). Dave Moorhouse has been the primary driving force to upgrade the facilities at the Kumeu Observatory, and to institute a programme of research looking for extrasolar planets using gravitational lensing. Dave has also been teaching a group of members the basics of astrophotography. He will present some of the work they have been doing at Kumeu along with some of his results and some of the images that he and members of the Society have been working on.

March Society Meeting

Do we really Need the Moon?

BBC Documentary with Dr Maggie Aderin-Pocock

Report by Clive Bolt

A very appropriate subject for the March Society Meeting with the Moon at Apogee on the 19th of the Month and consequently the largest it has appeared in the sky for 20 years. In answer to the question posed by the title of the documentary, probably yes, we do need the Moon.

Dr Aderin-Pocock started the programme with a flight over the Barringer Crater in Arizona to show that impacts from large objects are common on astronomical timescales and if we look up at the Moon, we can see the chaotic effects of the early Solar System imprinted on the surface of the Moon.

The early Moon as it might have been rising above the early Earth at a distance of just 40,000 kilometres

She explained that the Moon was formed some 4 billion years ago when a Mars sized object hit the early Earth, causing the Earth to tilt and releasing sufficient energy to melt most of the planet. The ejecta formed the Moon. The Moon at that time was only about 40,000 kilometres distant compared with today at about 365,000 Kilometres. 400-million-year-old coral fossils show daily growth rings that indicate that the Earth rotated in just over 21 hours. The The The Moon orbits more slowly than the Earth rotates, consequently it has slowed the Earth's rotation rate over time. The rotational energy has transferred to the Moon contributing to a steady increase in orbital distance. The Apollo programme placed three laser reflectors on the Moon that have allowed us to measure the distance to the Moon over some 40 years and we can now calculate that the Moon is moving slowly away from the Earth at about the rate that your finger nails grow. Recently we have located two of the Russian Lunokhod robotic landers sent to the Moon in the 1970's. These provide additional laser reflectance and have contributed not only to accurate distance measurements, but have allowed scientists to determine that the Moon still has a small molten core.

Dr Aderin-Pocock at the Goddard Space Centre

But getting back to the question in hand, the Moon helps to stabilise the Earth's orbit. Dr Aderin-Pocock posits that without the influence of the Moon, the Earth's orbit would be more like Mars, which wobbles as much as 60°. If this were to happen to the Earth, the polar caps would melt, causing a 30 to 60 metre (depending upon which school of thought you belong to) rise in sea levels. Mars has considerable evidence of catastrophic flooding from its past. Additionally, many places on Earth would experience extremes of climate from polar to central equatorial desert over cycles of a year, extremes that would be beyond the ability of present land animal to survive or even to evolve to cope with. She posits that a 10% increase in the distance to the Moon would be likely to bring about such a scenario. The relationship between the Moon and the Earth is unique in the solar system and life on Earth has evolved because of the stability it provides.

So for many physical and sentimental reasons, yes, we really do need the Moon that we take so much for granted.

Calendar of Events for 2011

April Programme

Sat	2	From 4:00pm	Practical Astronomy. Autumn Dark Sky Night. Venue at Waitoki. See notice below.
Fri 8		7:30pm	Young Astronomers Note the change of date
Mon	11	8:00pm	Society Meeting. The Kumeu Observatory with Dave Moorhouse
Mon	18	8:00pm	Society AGM followed by Film Night with Gavin Logan The Elegant Universe 3
Wed	20	7:30pm	Council Meeting
Mon	25	8:00pm	Introduction to Astronomy with Bernie Brenner

DVD Recordings of Meetings

The Society is now video recording all of our guest speakers. The videos are edited and recorded onto DVD and they are available for members to borrow from the library as part of the benefits of membership.
In addition, we are also making the DVDs available as a subscription service. Subscribers will get a minimum of ten DVDs per year (of each of our guest speakers) posted out to them on a regular basis. Cost of this will be $130.00 per annum.
For more information on the DVD subscription please contact Andrew Buckingham on 09 473 5877 or email treasurer@astronomy.org.nz.

Welcome to New Members

Ben Hart (student)

Kathy Hancock (ordinary)

Rebecca Hall (family)

Bojan Jankuloski (student)

Michele Wilton (ordinary)

Tasleem Hussein (family)

Petra Tang (ordinary)

May Programme

Mon	2	8:00pm	Practical Astronomy. Rain date Monday 4th
Fri	6	7:30pm	Young Astronomers.
Mon	9	8:00pm	Society Meeting. TBA
Mon	16	8:00pm	Film Night with Gavin Logan
Wed	18	7:30pm	Council Meeting
Mon	23	8:00pm	Introduction to Astronomy with Bernie Brenner

Practical Astronomy Saturday April 2nd Any time from 4:00pm

A club night based on getting started with learning the night sky and using your telescope with Host Andrew Buckingham

Venue is at 490 Whitehills Road Waitoki (near Silverdale).

Bring Telescopes, binoculars and BBQ

If the weather is bad, the session will revert to Monday 4th at the Stardome. The programme will then be hosted by Bill Thomas on the subject of observing open clusters.

See full notice & directions on P7.

Film Night Monday April 18 9:00pm With Gavin Logan

The third part of physicist Brian Greene's controversial three-part documentary "The Elegant Universe".

The Elegant Universe brings to light many ideas about the Universe and existence, enhanced with some interesting, entertaining and unusual film work. There is a large cast of scientists, mathematicians and others on both sides of a controversial unified "Theory of Everything". Extra dimensions, parallel universes, and a universe made out of strings of energy?

Part 3 Welcome To The 11th Dimension. This Part is 45 minutes long and can be watched as a stand alone movie.

Aprils Film Night is to be held after the Society AGM. The film will start at approximately 9 p.m.

Can One Theory of Physics Explain All Existence?

The March Film Night

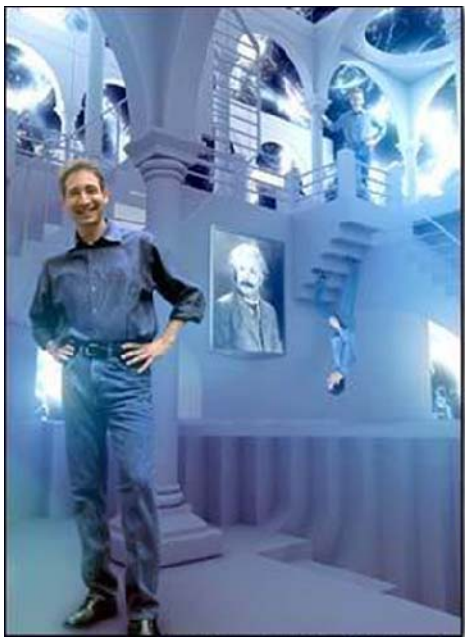
Report by Gavin Logan

The mysteries of existence made for another well attended Film Night in March. The audience watched parts 1 and 2 of Brian Greene's controversial three-part documentary "The Elegant Universe". Brian Greene is an American theoretical physicist and string theorist. He has been a professor at Columbia University since 1996. String Theory proposes that the cosmos can be thought of as consisting of tiny strings of energy or membranes that vibrate in ten spatial dimensions. The theory and the mathematics behind it provide a "Theory of Everything".

The first film explored Einstein's failure in his later life to create a unified "Theory of Everything", and how gravity presented a big problem in doing this. It gave the historical background to this from Newton's work on gravity to Einstein's theories. It showed that the theories of Quantum Mechanics and General Relativity pose contradictions and explains how String Theory could resolve those contradictions.

It postulated that something was missing in the theory of the "big" (cosmology) and the theory of the "small" (particle physics) as both behaved very differently, appearing to be governed by different laws.

The second film looked at modern theories of physics (Quantum Mechanics) and the development of the "Standard Model" and the way this related to the "Theory of Everything". It showed how



Physicist Brian Greene, host of "The Elegant Universe," walks a multiplicity of staircases in a scene inspired by artist M.C. Escher.

the mathematical equation to validate String Theory was developed. It showed the way in which extra dimensions that we cannot see could exist. The world's leading scientists are interviewed and made comments ranging from "this theory could provide the answer" to "is this a theory of physics or a philosophy"? String Theory cannot be proven or disproven because the particles at the centre of it are too small to be seen by present technology. As one scientist said of this "the theory is safe for the moment".

To add to the entertainment value, the films draw heavily on computer animation and green-screen virtual effects, with Greene's image added to fanciful digital settings. During one segment, Greene takes viewers on a tour of a "Quantum Cafe" where the jittery quantum world is scaled up into a cocktail lounge. Walls shimmer, bar patrons fade in and out of existence, and multiple Greenes reach for a glass of orange juice that morphs from blue to red to green.

Next month the final part of the series "Welcome to the 11th Dimension" will be shown.

The next Film Night is on 18th April after the Society's Annual General Meeting at the Stardome.

The film is about 50 minutes long and can be watched as a standalone movie, but for those who have seen and enjoyed the first two parts, this is a not-to-be-missed movie.

Another packed room for March's film night

Society Telescopes For Hire

The Society has a wide range of telescopes for hire to members.

If you are looking to purchase or upgrade a telescope and are not sure what to buy, this is a very good way to evaluate some of the available equipment. See also the advertisement on the back page.

To inquire about hiring or for advice on what to buy and for information about equipment, contact Ivan Vazey, curator of instruments, at ivazey@surfer.co.nz ph(09) 535-3987

March Star Party & A Public Outreach

By Gavin Logan

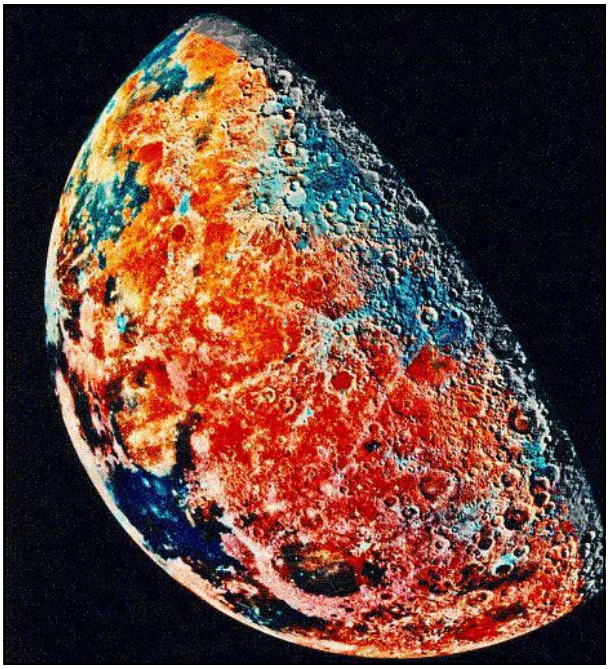
The dark sky evening that had been planned for Saturday 5th March had to be cancelled because of cloudy skies, but the following Monday the weather obliged with a clear night. After a planetarium show covering the highlights of the autumn sky telescopes were set up in Stardome's courtyard and for the next two hours attendees looked at the sky through a variety of telescopes.

Of particular interest was a Russian-built 100mm F10 Tal refractor. This is a telescope rarely seen in New Zealand, but with a reputation for being sturdily built and having fine optics.

Ivan Vazey, Curator of instruments, inspecting the optics of the 100mm Russian made Tal refractor at the March Star Party

In spite of intermittent cloud, many members of the public were treated to telescopic views of the Moon at a public stargazing evening run by the Society at Pakuranga on Saturday March 12th. It was part of a day-long festival organised by the Te Tuhi Centre for the Arts.

Members of the public being shown the Moon by Society members in Pakuranga.



Left: *This false-colour mosaic was constructed from a series of 53 images taken through three spectral filters by Galileo's imaging system as the spacecraft flew over the northern regions of the Moon on December 7, 1992. The part of the Moon visible from Earth is on the left side in this view. The colour mosaic shows compositional variations in parts of the Moon's northern hemisphere. Bright pinkish areas are highlands materials, such as those surrounding the oval lava-filled Crisium impact basin toward the bottom of the picture. Blue to orange shades indicate volcanic lava flows.*

AUCKLAND ASTRONOMICAL SOCIETY

Notice of Annual General Meeting

The Annual General Meeting of the Auckland Astronomical Society Inc. will be held in the Space Room of the Stardome Observatory, One Tree Hill Domain on **Monday 18th April 2011** starting at **8:00pm**.

All society members are invited to attend and help with the future of the society. The meeting will be followed by a supper and a film night video.

The agenda and a copy of the reports will be posted on the member's area of the society website (www.astronomy.org.nz) at least one week before the meeting. Printed copies will also be distributed at the meeting.

Nominations are open for all council positions; President, Vice President, Treasurer, Secretary, Librarian, Curator of Instruments, Editor and three council members.
Nominations must be received in writing to the Secretary by Monday 4th April and can be made by on the below form. Note nominees and nominators must be currently financial members

Any questions or enquires can be directed to Grant Christie (President) by email to info@astronomy.org.nz or phone 09 636 3437.

NOMINATION FOR AUCKLAND ASTRONOMICAL SOCIETY COUNCIL

To be completed by the nominator. The nominator must be a current financial member.

I .... nominate .....

for the position of .....

signed: ..... dated: .....

To be completed by the nominee. The nominee must be a current financial member and have been so for at least one year.

I .... accept nomination for .....

signed: ..... dated: .....

SEND FORM TO:
The Secretary
Auckland Astronomical Society
PO Box 24187
Royal Oak, Auckland 1345

Must be received before 4th April 2011.

Autumn Dark Sky Observing Night

Saturday 2nd April from 4:00pm

Bring BBQ, telescopes and Binoculars

490 Whitehills Rd
Waitoki (near Silverdale)

The Event

After we were rained out last month, we are going to try again with having a session in a dark sky. Dave Wyers has kindly agreed to host the event at his place on the north side of Auckland. The darker sky will give us a fantastic opportunity to explore the Autumn Night sky. We are going to start in the late afternoon so we can do some solar viewing. Once the Sun sets we start telescope viewing and should continue until at least midnight (cloud permitting).

Feel free to bring a telescope or binoculars. There is plenty of flat ground to set up on. There will also be some AAS telescopes available for use. It is the last night of daylight saving time, so you will even get an extra hour's sleep.

This is designed to be a relaxed social occasion so please bring a picnic or BBQ food and any supplies you need for the evening. If you are able to bring a BBQ please let us know.

Directions

Take the Northern Motorway north and exit at Silverdale (Exit 398)

Turn left and take the first right (Pine Valley Rd) and follow to the end.

Turn right, then right again into Whitehills Rd.

Follow for about 5km. No. 490 is on your right near the end of the road.

Total distance is about 40km from the Harbour Bridge. Allow 45 minutes from the bridge.

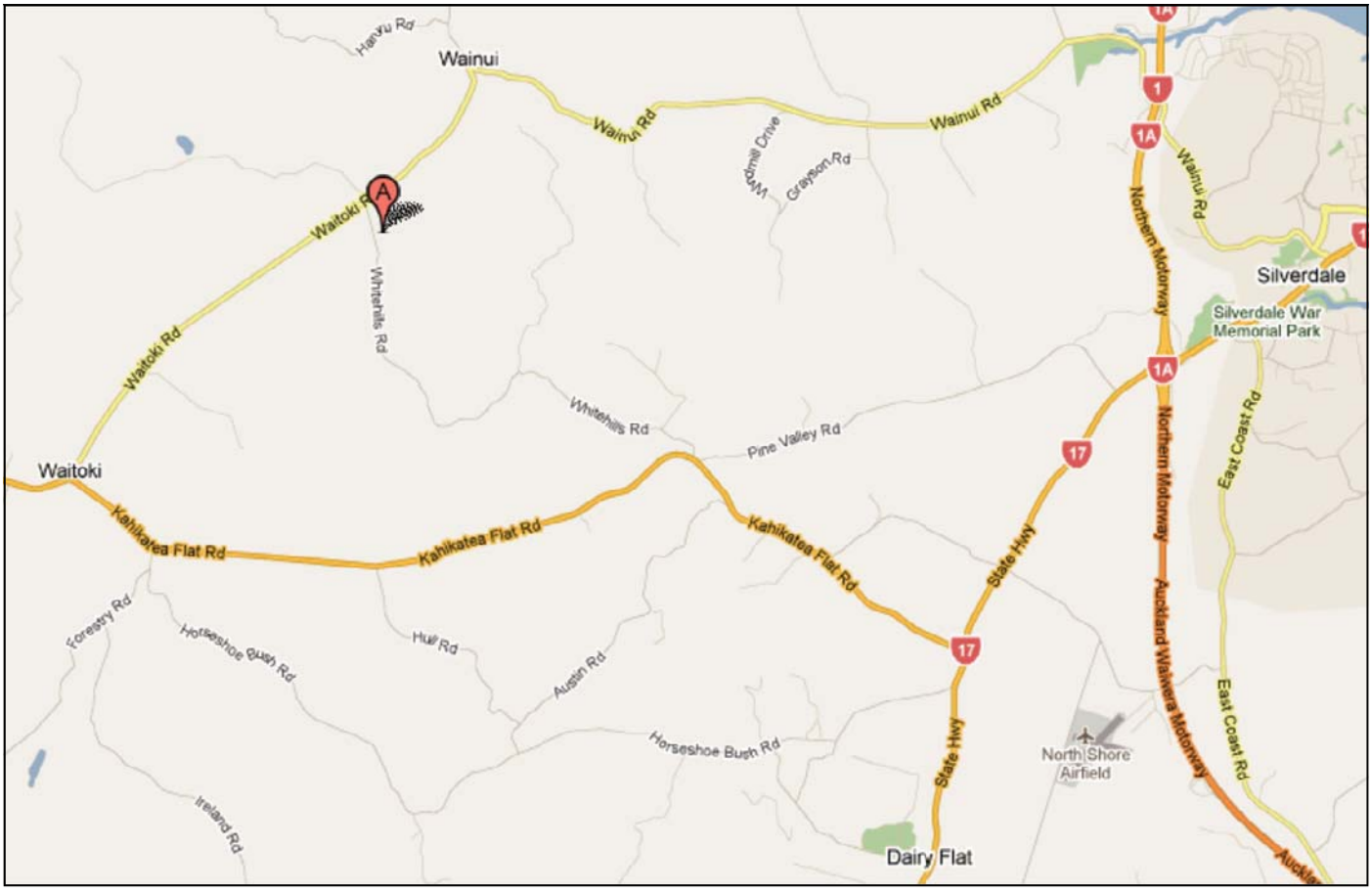
Registration

If you are planning to come to this event, please register with Andrew Buckingham by email at treasurer@astronomy.org.nz or by phone on 09 473 5877. This to help us plan for the numbers attending and to keep you updated on conditions.

Weather

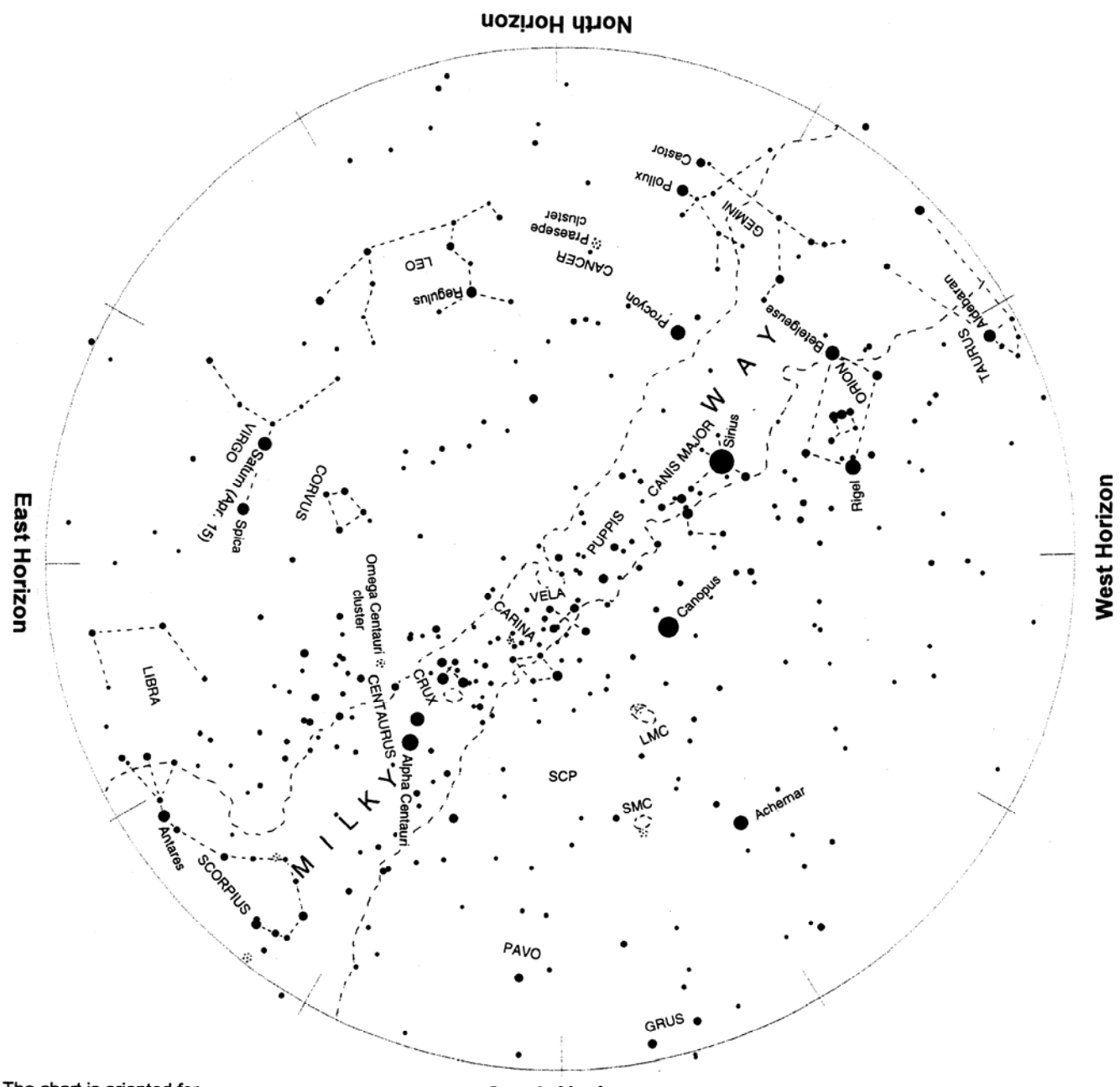
This event is weather dependent. Please check the AAS website (www.astronomy.org.nz) for cancellation information or phone Andrew Buckingham on 09 473 5877 or 027 246 2446. We will also send out an email on Saturday afternoon with an update.

If the event is cancelled we will revert to the session on Monday evening (4th April) at the Stardome Observatory.



The Evening Sky in April 2011

By Alan Gilmore, The University of Canterbury, Mt John Observatory, www.canterbury.ac.nz



The chart is oriented for
Mar. 15 at 11 p.m. NZDT
April 1 at 10 p.m. "
April 15 at 8 p.m. NZST
May 1 at 7 p.m. "

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 westward or clockwise shift each night as we orbit the Sun.

Sirius, the brightest star, is midway down the western sky. Below it is Orion with bright stars Rigel and Betelgeuse. Orion's belt and sword, aka 'The Pot', appears between them. Canopus, the second brightest star, is southwest of overhead. Saturn is in the east with fainter Spica to its right. Crux, the Southern Cross, and The Pointers, Alpha and Beta Centauri, are high in the southeast sky. The Scorpion, on its back, is rising in the southeast. The Milky Way spans the sky from SE to NW.

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 April 2011

By Alan Gilmore

Sirius is the first star to appear at dusk, midway down the northwest sky. It is soon followed by Canopus, southwest of the zenith. Below Sirius are Rigel and Betelgeuse, the brightest stars in Orion. Between them is a line of three stars: Orion's belt. To southern hemisphere star watchers, the line of three makes the bottom of 'The Pot', now tipped on its side. Orion's belt points down and left to a V-shaped pattern of stars making the face of Taurus the Bull. Below and right of Sirius is Procyon. The planet Saturn is in the east sky, making a widely spaced pair with Spica. In the southeast are the Pointers, Beta and Alpha Centauri, with Crux, the Southern Cross, above them.

Sirius, 'the Dog Star', marks the head of Canis Major the big dog. A group of stars above it make the dog's hindquarters and tail. Sirius is the brightest star in the sky both because it is relatively close, nine light years* away, and 23 times brighter than the Sun.

Low in the north are Pollux and Castor, the heads of Gemini the twins, making a line vertical to the skyline. Above and right of them is the Praesepe cluster, marking the shell of Cancer the crab. Praesepe is also called the Beehive cluster, the reason obvious when it is viewed in binoculars. It is 500 light years away.

Further right is Regulus, the brightest star of Leo. Below Regulus a sickle-shaped pattern of stars makes the lion's mane. To its right a zigzag of stars form the lion's hind legs. Leo is upside down to us as these constellation pictures were thought up by northern hemisphere sky watchers.

Saturn is the brightest 'star' in the empty eastern sky at dusk. To its right, and slightly fainter, is Spica the brightest star in Virgo. Saturn's rings appear quite narrow in a telescope after being edge-on for the past two years. Saturn is 1,300 million km away in mid April. It is midway up the north sky by midnight.

Rigel, left of Orion's belt, is a bluish supergiant star, 40,000 times brighter than the Sun and much hotter. It is 800 light years away. Orange Betelgeuse, right of the line of three, is a red-giant star, cooler than the Sun but much bigger and 9,000 times brighter. It is 400 light years from us. The handle of "The Pot", or Orion's sword, has the Orion Nebula at its centre; a glowing gas cloud many light-years across and around 1,300 light years away.

Crux, the Southern Cross, is high in the southeast. Below it, and brighter, are Beta and Alpha Centauri, often called 'The Pointers'. Alpha Centauri is the closest naked-eye star, 4.3 light years away. Beta Centauri, like most of the stars in Crux, is a blue-giant star hundreds of light years away. Canopus is also a very luminous distant star; 13,000 times brighter than the Sun and 300 light years away.

The Milky Way is brightest in the southeast above Crux. The Milky Way can be traced to nearly overhead where it fades. It becomes very faint in the northwest, right of Orion. The Milky Way is our edgewise view of the galaxy, the pancake of billions of stars of which the Sun is just one. The centre of the galaxy is toward Sagittarius, below Scorpio's sting, where the Milky Way is broad and bright.

The Clouds of Magellan, LMC and SMC are midway down the southwest sky, easily seen by eye on a dark moonless night. They are two small galaxies about 160,000 and 200,000 light years away.

Brilliant Venus rises in the east after 4 a.m. It circles the Sun faster than us and is now moving to the far side. Near the end of April the planets Mercury, Mars and Jupiter will all appear in the dawn sky below Venus. Mercury passes us on April 9 and is moving to the far side of the Sun. It appears just below Venus but is much fainter. We are catching up on Mars and Jupiter which are presently on the far side of the Sun. They are close together in the sky, well below Venus. Jupiter is bright, though outshone by Venus. Mars has an orange tint and similar brightness to Mercury. On April 30 their distances from us are: Mercury 107 million km; Venus 215 million km

*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 April 2011

From the RASNZ Website

April 2	Moon at apogee, its greatest distance from the Earth for the Lunar month and for 2011, 406657 km.
April 4	New Moon at 2.32am NZST (Apr 3, 14:32 UT).
April 4	Close conjunction of Mars, mag 1.2 and Uranus, mag 5.9. very low to east in dawn sky.
April 4	Saturn at opposition.
April 7	Jupiter at conjunction, far side of Sun.
April 9	Moon furthest north, so lowest southern hemisphere transit for the month.
April 9	Pluto stationary.
April 10	Mercury at inferior conjunction, between the Sun and Earth.
April 12	Moon at first quarter at 12.05am NZST (Apr 11, 12:05 UT).
April 14	80% lit Moon 4° above of Regulus, Leo, magnitude 1.4, evening sky.
April 17	Moon at perigee, its closest to the Earth for the lunar month, 358090 km.
April 17	Almost full Moon 7.5° to upper right of Saturn and 7.5° to upper left of Spica, Virginis, mid-evening sky.
April 18	Full Moon at 2.44pm NZST (02:44 UT)
April 20	Close conjunction of Mars and Mercury very low to east in dawn sky.
April 21	90% lit Moon 5° below Antares, Scorpii, magnitude 1.1, morning sky and 8° below Antares, mid evening when 85% lit.
April 21/22	Moon furthest south, so highest southern hemisphere transit for the month.
April 22	Mercury stationary.
April 23/24	Venus in close conjunction with Uranus, morning sky.
April 25	Moon at last quarter 2.47pm NZST (14:47 UT).
April 30	Moon at apogee (2nd in April), its greatest distance from the Earth for the Lunar month, 406038 km.

The 2011 Yearbook is Still available

Members can purchase copies directly from the Society at the discounted price of $14.00 + $2.00 postage (normal retail is $20)

The 2011 edition celebrates the 50 year anniversary of the first man in space and Neptune's first orbit since discovery. Other articles include; Rockets in NZ, Radio Astronomy, space junk, the Pleiades star cluster and the Mt John Observatory.

A full set of monthly sky guides along with rise and set times for the Sun, Moon and planets are also included.

To order a copy, contact Andrew Buckingham at treasurer@astronomy.or.nz or phone 09 473 5877.

They will also be available on Meeting nights. Note this special pricing is not available from the Stardome shop

Two Devastating Earthquakes

By Alan Gilmore, RASNZ Newsletter 123

Two devastating Earthquakes occurred in the past month. A magnitude 6.3 quake close to Christchurch killed around 180 people in the CBD. A much bigger shake, magnitude 9 and 300 km off the coast of Japan produced a devastating tsunami that destroyed towns and villages along several hundred km of coast, killing thousands. Our thoughts are with friends and colleagues in both places.

Canterbury Earthquake

On February 22 a Richter magnitude 6.3 earthquake devastated much of central Christchurch and some surrounding suburbs. Being centred just 10 km southeast of the CBD and only 5 km down the quake produced much more severe shaking than did September 4's magnitude 7.1 earthquake. The earlier quake was centred near Darfield, some 40 km west of Christchurch at a depth of 15 km. [See Newsletter No. 118, Item 2.]

A Wikipedia article forwarded by Philip Barker gave an early analysis: "... the vertical acceleration was far greater than the horizontal acceleration. The intensity felt in Christchurch was MM VIII. [MM is the Modified Mercalli scale. It gives the shaking intensity on the ground. The Richter magnitude gives the total energy release of the earthquake. -- Ed.] The peak ground acceleration (PGA) in the Christchurch area exceeded 1.8g (i.e. 1.8 times the acceleration of gravity), with the highest recording 2.2g, at Heathcote Valley Primary School, a shaking intensity equivalent to MM X+. This is the highest PGA ever recorded in New Zealand; the highest reading during the September 2010 event was 1.26g, recorded near Darfield."

Later analysis indicates that the quake energy was 'aimed' at the Christchurch CBD by the direction of the fault. Bill Fry, a seismologist with Geological and Nuclear Sciences, was reported in the 'The Press' (March 18, p.A4) as saying that the waves from the fault rupture, and the rupture, were moving in the same direction, concentrating the energy.

The historic Townsend Observatory, at the old University of Canterbury site -- now the Arts Centre -- in downtown Christchurch, was destroyed. The observatory tower had been weakened by the September earthquake. Plans were afoot to remove the venerable Townsend Telescope from the observatory once the tower had been stabilized. The telescope was a 6-inch Thomas Cooke & Sons refractor made in 1864. Sadly the February 22nd quake overtook this work. Photos of the observatory and the telescope appear on the cover of the March issue of Southern Stars. On page 9 of the same issue is a photo taken by Mita Brierley of the destroyed tower with, presumably, the telescope in the debris. Mita, a recent Canterbury PhD in astronomy, was part of a search and rescue team working in the CBD after the earthquake.

The runied Townsend Observatory at the Arts Centre in Canterbury

Canterbury University's Department of Physics and Astronomy is housed in the Rutherford building on the University's Ilam campus west of the CBD. The building is a solid 1960s Ministry of Works design. Early indications are that it has no structural damage, despite several more recent buildings on the campus being 'red stickered'. It is hoped that students and staff can re-occupy Rutherford in mid April.

Japanese Earthquake

As far as is known, the shaking from the March 11 Japanese earthquake did little damage to astronomical equipment. Sendai Observatory (E Long. +140° 51.9', Lat. +38° 15.4', altitude 45 metres) is the closest well-known astronomical facility to the epicentre.

The global effects of the earthquake are still being calculated. Some early results have been seen in the news media. The Japanese east coast moved 4 metres east. The oceanic plate (on the other side of the plate boundary) moved 20 metres west. The dipped part of the plate, a slab 400 km wide and 100 km long, moved down about 10 metres.

Earth's axis moved 16.5 cm. This is no big deal. The Earth moves many metres in relation to the axis every year. It's called the Chandler wobble. Earth's rotation rate shortened by 1.8 microseconds. So a day is now 1.8 millionths of a second shorter than it was before. The length of day varies by tens of milliseconds (thousandths of a second) over a year due to northern hemisphere seasons. In both cases it is caused by stuff being moved closer to, or further from, the rotation axis.

Researchers Crack the Mystery of the Missing Sunspots

From NASA

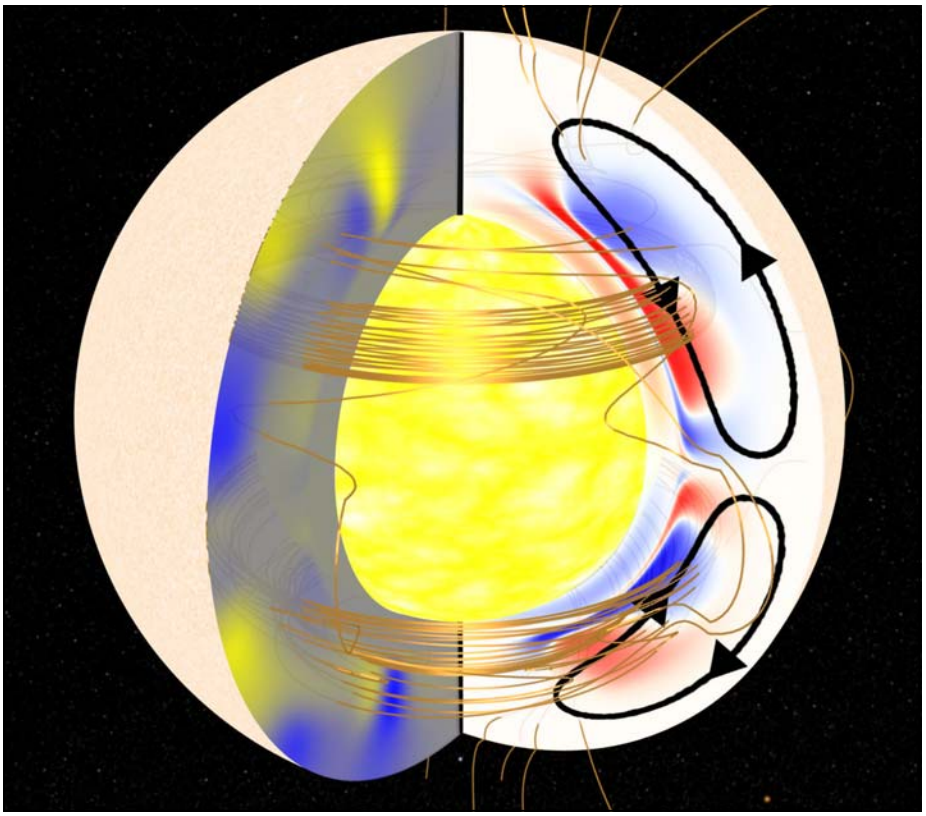
In 2008-2009, sunspots almost completely disappeared for two years. Solar activity dropped to hundred-year lows; Earth's upper atmosphere cooled and collapsed; the Sun's magnetic field weakened, allowing cosmic rays to penetrate the Solar System in record numbers. It was a big event, and solar physicists openly wondered, where have all the sunspots gone?

Now they know. An answer is being published in the March 3rd edition of Nature.

In this artistic cutaway view of the Sun, the Great Conveyor Belt appears as a set of black loops connecting the stellar surface to the interior. Credit: Andrés Muñoz-Jaramillo of the Harvard CfA. "Plasma currents deep inside the Sun interfered with the formation of sunspots and prolonged solar minimum," says lead author Dibyendu Nandi of the Indian Institute of Science Education and Research in Kolkata. "Our conclusions are based on a new computer model of the Sun's interior."

For years, solar physicists have recognized the importance of the Sun's "Great Conveyor Belt." A vast system of plasma currents called 'meridional flows' (akin to ocean currents on Earth) travel along the Sun's surface, plunge inward around the poles, and pop up again near the Sun's equator. These looping currents play a key role in the 11 -year solar cycle. When sunspots begin to decay, surface currents sweep up their magnetic remains and pull them down inside the star; 300,000 km below the surface, the Sun's magnetic dynamo amplifies the decaying magnetic fields. Re-animated sunspots become buoyant and bob up to the surface like a cork in water—voila! A new solar cycle is born.

For the first time, Nandi's team believes they have developed a computer model that gets the physics right for all three aspects of this process--the magnetic dynamo, the conveyor belt, and the buoyant evolution of Sunspot magnetic fields.



In this artistic cutaway view of the Sun, the Great Conveyor Belt appears as a set of black loops connecting the solar surface to the interior. Credit: Andrés Muñoz-Jaramillo of the Harvard CfA.

"According to our model, the trouble with sunspots actually began back in the late 1990s during the upswing of Solar Cycle 23," says co-author Andrés Muñoz -Jaramillo of the Harvard-Smithsonian Center for Astrophysics. "At that time, the conveyor belt sped up."

The fast-moving belt rapidly dragged sunspot corpses down to Sun's inner dynamo for amplification. At first glance, this might seem to boost sunspot production, but no. When the remains of old sunspots reached the dynamo, they rode the belt through the amplification zone too hastily for full re-animation. Sunspot production was stunted.

Sunspot cycles over the last century. The blue curve shows the cyclic variation in the number of sunspots. Red bars show the cumulative number of sunspot-less days. The minimum of sunspot cycle 23 was the longest in the space age with the largest number of spotless days.

Later, in the 2000s, according to the model, the Conveyor Belt slowed down again, allowing magnetic fields to spend more time in the amplification zone, but the damage was already done. New sunspots were in short supply. Adding insult to injury, the slow moving belt did little to assist re-animated sunspots on their journey back to the surface, delaying the onset of Solar Cycle 24.

"The stage was set for the deepest solar minimum in a century," says co-author Petrus Martens of the Montana State University Department of Physics.

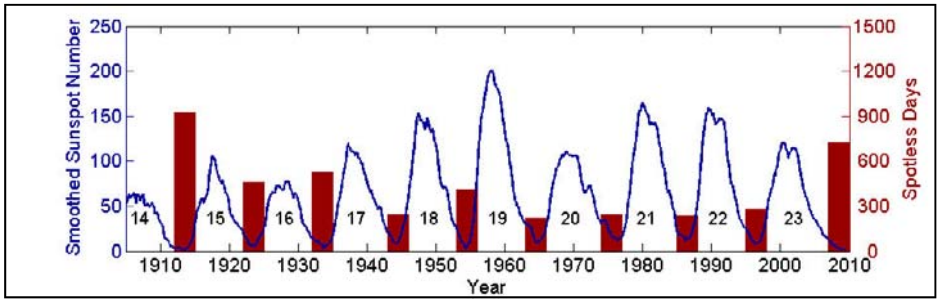
Colleagues and supporters of the team are calling the new model a significant advance.

"Understanding and predicting solar minimum is something we've never been able to do before---and it turns out to be

very important," says Lika Guhathakurta of NASA's Heliophysics Division in Washington, DC.

Three years ago on March 2, 2008, the face of the Sun was featureless--no sunspots. Credit: SOHO/MDI. While Solar Max is relatively brief, lasting a few years punctuated by episodes of violent flaring, over and done in days, Solar Minimum can grind on for many years. The famous Maunder Minimum of the 17th century lasted 70 years and coincided with the deepest part of Europe's Little Ice Age. Researchers are still struggling to understand the connection.

One thing is clear: During long minima, strange things happen. In 2008-2009, the Sun's global magnetic field weakened and the solar wind subsided. Cosmic rays normally held at bay by the Sun's windy magnetism surged into the inner solar system. During the deepest solar minimum in a century, ironically, space became a more dangerous place to travel. At the same time, the heating action of UV rays normally provided by sunspots was absent, so Earth's upper atmosphere began to cool and collapse.



Sunspot cycles over the last century. The blue curve shows the cyclic variation in the number of Sunspots. Red bars show the cumulative number of sunspot-less days. The minimum of sunspot cycle 23 was the longest in the space age with the largest number of spotless days. Credit: Dibyendu Nandi et al.

Space junk stopped decaying as rapidly as usual and started accumulating in Earth orbit. And so on….

Nandi notes that their new computer model explained not only the absence of sunspots but also the Sun's weakened magnetic field in 08-09. "It's confirmation that we're on the right track."

Next step: NASA's Solar Dynamics Observatory (SDO) can measure the motions of the Sun's conveyor belt—not just on the surface but deep inside, too. The technique is called helioseismology; it reveals the Sun's interior in much the same way that an ultrasound works on a pregnant woman. By plugging SDO's high-quality data into the computer model, the researchers might be able to predict how future solar minima will unfold. SDO is just getting started, however, so forecasts will have to wait.

Indeed, much work remains to be done, but, says Guhathakurta, "finally, we may be cracking the mystery of the spotless Sun."

Credits: This research was funded by NASA's Living With a Star Programme and the Department of Science and Technology of the Government of India.

April is Global Astronomy Month

From RASNZ Newsletter by Alan Gilmore

April 2011 is Global Astronomy Month. It continues the successful International Year of Astronomy 2009 (IYA2009). (AWB) Astronomers Without Borders is dedicated to fostering understanding and goodwill across national and cultural boundaries by creating relationships through the universal appeal of astronomy.

Astronomers Without Borders projects promote sharing. Sharing resources. Sharing knowledge. Sharing inspiration. All through a common interest in something basic and universal.

Sharing the sky.
A host of events are planned worldwide throughout April 2011 (see list below), all amateur and professional astronomers and in fact anybody is invited to participate. Local astronomy societies are encouraged to run at least one event for the public, giving the public a chance to explore and enjoy our night sky.

To support Global Astronomy Month the Society will be having teams of members offering free public telescope viewing on the 14th, 15th and 16th April at a number of locations around Auckland.

The planned locations are Henderson, Manukau, Devonport and the Viaduct Basin. More details will be sent out by email in early April and will be on the AAS website.
If you are interested in being part of this event, please contact Andrew Buckingham on 09 473 5877 or email treasurer@astronomy.org.nz.

Local astronomical societies and interested groups are invited to register their event at http://www.astronomerswithoutborders.org/global-astronomy-month-2011.html

You are also invited to join the AWB New Zealand Google group newsletter to keep up to date with the AWB events in New Zealand. http://groups.google.com/group/awb-nz-newsletter?hl=en-GB&pli=1

Robert McTague, Astronomers Without Borders New Zealand Coordinator, 28 Kiwi Drive, Timaru. Ph 03-688 3735.

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Society Contacts

Auckland Astronomical Society Inc,

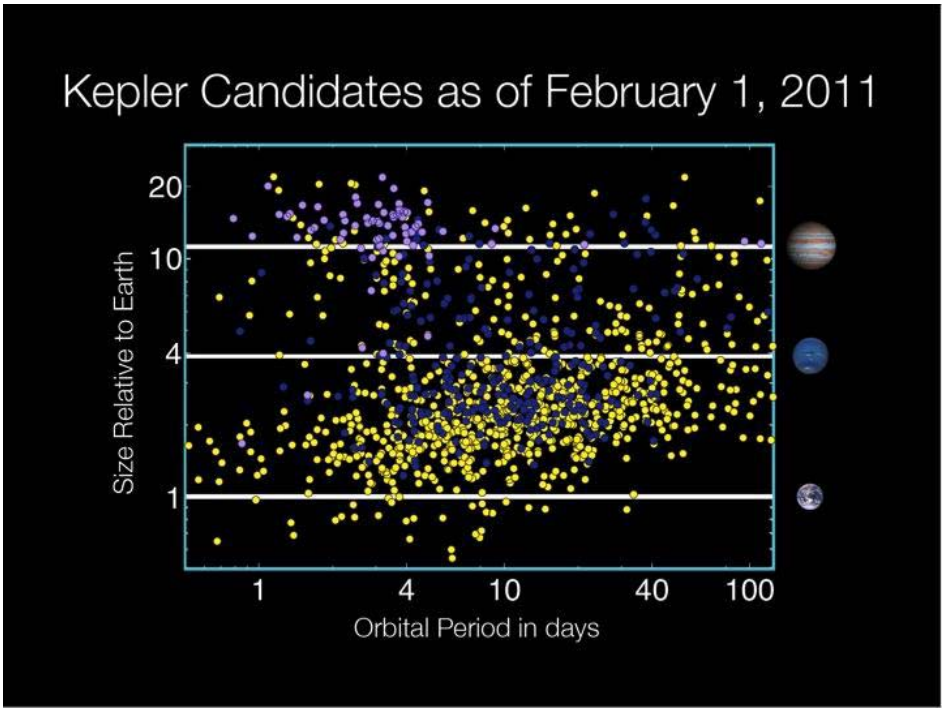
P O Box 24-187, Royal Oak,
Auckland 1345, New Zealand

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

Planets Everywhere

By Kurtis Williams. Article provided by the AAVSO writer's Bureau



Today, NASA and the Kepler Mission team announced the most up-to-date results of the Kepler mission's search for planets around other stars. Today's haul was nothing short of astounding (though, dare I say, mostly expected): 1,235 candidates, 68 of which are Earth-sized. 54 planet candidates (not necessarily the same ones that are Earth-sized) are the right distance from their parent star that they could have liquid water. 170 of these 1200 candidates also show some evidence of being in multiple-planet systems, and one has at least six planets!

Originally, I was going to miss the press conference, because I was supposed to be teaching a class at that time. Then our classes were cancelled due to an ice storm, so I intended to watch the press conference. However, I was unable to watch the press conference when my apartment was hit by the 5th in an ongoing series of rolling blackouts to hit the Dallas area. So, I have to pick up the highlights from the web.

NASA's Kepler Mission's main goal is to find Earth-sized planets in Earth-like orbits around Sun-like stars. Kepler works by watching for planets whose orbits carry them directly between their parent star and the Earth. This means that Kepler will not see most of the planets that are out there, as this alignment is rare.

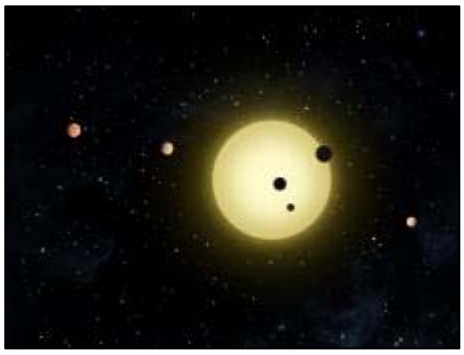
Before today, we mostly had heard about planets from Kepler that were very close to their parent star and absolutely, positively, undoubtedly real. Today, roughly 1200 new planet candidates were announced, and perhaps 20% of them may not be real. More on that in a minute.

There are many reasons why so many of the first planets were close to the parent star. First, Kepler has to see a planet go in front of its parent star at least three times (in other words, complete at least three orbits) to know that it is real. One passage alerts the mission that this star is interesting, a second passage gives astronomers a predicted orbital period, and a third pass confirms that period.

The closer a planet is to its parent star, the more quickly it completes each orbit, and the sooner we've seen those magical three orbits.

But there are many other astronomical objects that can look like planets that really aren't planets. So much of the early work on candidate Kepler planets is to follow them up with ground-based telescopes. These telescopes can measure how fast the parent star moves in response to the planet's gravity, and confirms if we are seeing a planet, or if it is something else. These observations require a lot of time, so positive planet identifications are slow in coming. The closer a planet is to its parent star, the easier it is to make these measurements. So, the most certain planets in the early data tend to be big (their larger gravity tugs more on their parent star) and they tend to be very close to their home star.

As Kepler finds smaller planets further from their parent star, this follow-up work becomes prohibitive. The motion of the Sun due to the Earth's gravity cannot be measured with current telescopes, and each orbit of the Earth takes a year. So if we find a candidate Earth-sized planet in an Earth-like obit around a Sun-like star, we have few options for proving it is real beyond all doubt.



Here's an artist's conception of the Kepler -11 system

However, all the work that goes in to proving the close-in planets also tells the Kepler team how likely any one detection is to be real or not. And it seems that at least 80% of the Kepler planet candidates that pass some initial straightforward tests are real. So, while some of those 1200 planet candidates are probably not real, most of them probably are. If we know what percentage of the planets are likely false detections, we can still analyse Kepler's treasure trove of planets using statistics. This has been the plan all along, and this is Kepler's main mission goal -- to see how common planets are. The

results: they're everywhere. Which we already suspected.

One of the coolest planetary systems Kepler scientists announced today is that of Kepler-11. This star has at least six planets around it, and five of these are closer to the parent star than our planet Mercury, the closest planet to the Sun. There are so many planets close in to this star that they sometimes blend together, with more than one planet passing in front of the star at the same time. This is horribly difficult to disentangle! :

The Kepler mission will continue for several more years. It needs at least another 18 months before that desired trophy of an Earth-sized planet in an Earth -sized orbit around a Sun-like star will have had a chance to complete those all-important three orbits. We are getting closer all the time to knowing how common our Solar System is (or is not).

The last warning, which I've made before. Kepler only tells us the size (diameter) of the planets, not what they are made out of. So any Earth-sized planet in an Earth-sized orbit around a Sun-like star that Kepler finds could be as desolate as the Moon, as hellish as Venus, or as pleasant as the Earth. We don't have the ability to see how liveable these planets might be. Yet.

Gas Rich Galaxies Confirm Prediction of Modified Gravity Theory

From Science Daily

Recent data for gas rich galaxies precisely match predictions of a modified theory of gravity known as MOND, according to a new analysis by University of Maryland Astronomy Professor Stacy McGaugh. This -- the latest of several successful MOND predictions -- raises new questions about accuracy of the reigning cosmological model of the universe, writes McGaugh in a paper to be published in March in Physical Review Letters.

Modern cosmology says that for the universe to behave as it does, the mass-energy of the universe must be dominated by dark matter and dark energy. However, direct evidence for the existence of these invisible components remains lacking. An alternate, though unpopular, possibility is that the current theory of gravity does not suffice to describe the dynamics of cosmic systems.

A few theories that would modify our understanding of gravity have been proposed. One of these is Modified Newtonian Dynamics (MOND), which was hypothesized in 1983 by Moti Milgrom a physicist at the Weizmann Institute of Science in Rehovot, Israel. One of MOND's predictions specifies the relative relationship between the mass of any galaxy and its flat rotation velocity. However, uncertainties in the estimates of masses of stars in star-dominated spiral galaxies (such as our own Milky Way) previously had precluded a definitive test.

To avoid this problem, McGaugh examined gas rich galaxies, which have relatively fewer stars and a preponderance of mass in the form of interstellar gas. "We understand the physics of the absorption and release of energy by atoms in the interstellar gas, such that counting photons is like counting atoms. This gives us an accurate estimate of the mass of such galaxies," McGaugh said.

The star dominated spiral galaxy UGC 2885. (Credit: Zagursky & McGaugh)

Using recently published work that he and other scientists had done to determine both the mass and flat rotation velocity of many gas rich galaxies, McGaugh compiled a sample of 47 of these and compared each galaxy's mass and rotation velocity with the relationship expected by MOND. All 47 galaxies fell on or very close to the MOND prediction. No dark matter model performed as well.

"I find it remarkable that the prediction made by Milgrom over a quarter century ago performs so well in matching these findings for gas rich galaxies," McGaugh said. "

MOND vs. Dark Matter -- Dark Energy

Almost everyone agrees that on scales of large galaxy clusters and up, the Universe is well described by dark matter -- dark energy theory. However, according to McGaugh this cosmology does not account well for what happens at the scales of galaxies and smaller.

"MOND is just the opposite," he said. "It accounts well for the 'small' scale of individual galaxies, but MOND doesn't tell you much about the larger universe.

Of course, McGaugh said, one can start from the assumption of dark matter and adjust its models for smaller scales until it fits the current finding. "This is not as impressive as making a prediction ahead of [new findings], especially since we can't see dark matter. We can make any adjustment we need." This is rather like fitting planetary orbits with epicycles," he said. Epicycles were erroneously used by the ancient Greek scientist Ptolemy to explain observed planetary motions within the context of a theory for the universe that placed Earth in its centre.

"If we're right about dark matter, why does MOND work at all?" asks McGaugh. "Ultimately, the correct theory -- be it dark matter or a modification of gravity -- needs to explain this."

Stars Caught in Fiery Merger

By Ray Villard . Article provided by the AAVSO Writer's Bureau

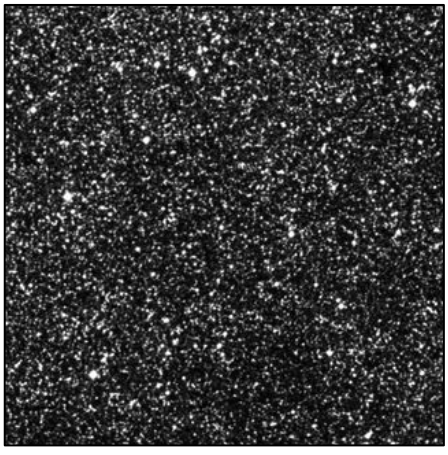
In 2002, astronomers witnessed one of the strangest celestial events ever. A star on the outskirts of our Milky Way briefly grew one million times brighter, outshining almost all other stars in our galaxy. It didn't explode as a supernova, but just sort of hiccuped a brilliant burst of light.

The star, called V838 Monocerotis, expanded to an enormous size, cooled and reddened (right). Since then razor-sharp Hubble Space Telescope pictures have caught the eerie "light echo" around the star as the glow from the flash rebounds off interstellar dust. This phenomenon gives the illusion that material is streaming off the star at velocities faster than the speed of light.

Astronomers remain at a loss to satisfactorily explain the outburst, but there has been lots of speculation. Did the star ignite helium at the core, swallow a planet, or swallow a companion star?

In September 2008, another strange stellar burst was seen deep in the heart of the Milky Way, 10,000 light-years away in the opposite direction of V838 Mon.

Called V1309 Scorpii, it too would have joined the "stellar weirdo" list if not for a fortuitous observation that caught the pre-disaster activity -- like a shopping mall security camera recording a crime from start to finish.



Our galactic surveillance camera is the nearly two decade-long Optical Gravitational Lensing Experiment (OGLE), that looks for small changes in the brightness of tens of millions of stars in the direction of the galactic centre.

V838 Monoceros

A major goal of the project is to capture gravitational microlensing events where an unseen body passes between a background star and Earth. This causes the background star to momentarily brighten as the gravitational field of the foreground object amplifies the starlight like a magnifying glass. Light changes can also be caused by intrinsically variable stars, and planets passing in front of stars.

From 2001 to 2008 the OGLE survey made over 1,300 observations of the orange dwarf star before it blew its top in 2008. The star just happened to be in the field of view.

The survey shows that the star oscillated in brightness for years before the brilliant flash. Mysteriously the oscillation period was first measured at 1.4 days but grew shorter leading up to the 2008 blow-out.

It's unlikely the variability could have been caused by star spots coming and going. A 1.4-day period would not remain so stable for so long. Like sunspots, starspots should change in size and migrate. It's also unlikely the star was pulsating because the oscillation rate got shorter over a several year period.

The best explanation is that actually two stars were seen orbiting edge-on to our line of sight. The amount of light from the system would momentarily drop every time one star passed behind the other. If the stars were spiralling together the orbital period would shorten, as observed.

The fast orbit meant that double star system was an unusual "contact binary" where a pair of stars are so close together they are nearly touching each other and share a common coronal envelope -- like a pair of waltzing skaters whirling around each other rapidly. Friction between the two stars would put drag on the system, and rob orbital momentum, causing the stars to get closer to each other.

When the stars merged all hell broke

loose. The momentum from the orbit was converted to heat, causing the new merged star to skyrocket in temperature. The star also suddenly grew 10,000 times brighter.

Massive Cosmic Explosions

Imagine for a moment that the contact binary had an inhabited planet with an advanced civilization. Its astronomers would have noted the shortening orbital period between the binary duo.

This would presage a true apocalypse for the civilization. Anticipation would be reminiscent of today's "2012" silly doomsday hysteria, except this would be for real. Astronomers would realize that the inevitable merger would incinerate the surface of their planet, perhaps boil away its oceans, and strip away the atmosphere. They would have a real doomsday clock that counted down each shrinkage of the binary's orbital period.

ANALYSIS: Why Does a Star Explode?

A space ark with a small population of refuges might be dispatched to find shelter on a moon of one of the system's gas giant outer planets. That is, assuming the merged star did swell up big enough to devour the entire system, as V838 Mon has done.

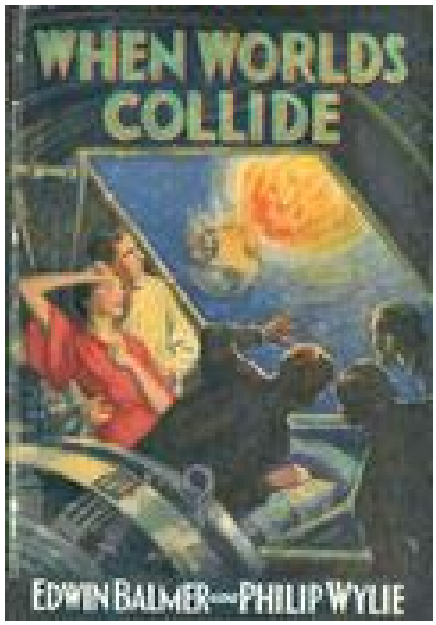
At the right distance, they would be in a newly expanded habitable zone around the swelled-up star.

The civilization's political and social upheaval would be unimaginably severe because only a fraction of the global population of planet could be saved. Independent nations would embark on a technological "survival-race" to see how many citizens could be launched off the planet. The 1933 science fiction novel "When Worlds Collide," presents just such a scenario.

Those left on the doomed planet might gamble to set up survival habitats in deep underground caverns with air, water and food processing capabilities.

This is also reminiscent of the projection of a post-nuclear holocaust underground shelters envision in the 1964 dark-comedy film, "Dr. Strangelove":

U.S. President: "Well I... would hate to



have to decide.. who stays up and.. who goes down."Dr. Strangelove: " . . .a computer could be set and programmed to accept factors from youth, health, sexual fertility, intelligence, and a cross section of necessary skills. Of course it would be absolutely vital that our top government and military men be included to foster and impart the required principles of leadership and tradition."

Yeah...Right ***ED***

Artwork credit: ESO

Solving the Mystery of Dark Gamma Ray Bursts

By Mike Simonsen, Simostronomy

Article provided by the AAVSO Writer's Bureau

Unravelling the mystery of Gamma Ray Bursts (GRBs) is a story filled with international intrigue, fantastic claims, serious back-tracking, and incremental improvements in our understanding of the true nature and implications of the most energetic, destructive forces in the Universe. New results from a team of scientists studying so-called "dark gamma-ray bursts" have firmly snapped a new piece into the GRB puzzle. This research is presented in a paper to appear in the journal Astronomy & Astrophysics on December 16, 2010.

The discovery of GRBs was an unexpected result of the American space programme and the military keeping tabs on the Russians to verify compliance with a cold war nuclear test ban treaty. In order to be sure the Russians weren't detonating nuclear weapons on the far side of the Moon, the 1960's era Vela spacecraft were equipped with gamma ray detectors. The Moon might shield the obvious signature of x-rays from the far side, but gamma rays would penetrate right through the Moon and would be detectible by the Vela satellites.

By 1965, it became apparent that events which triggered the detectors but were clearly not signatures of nuclear detonations, so they were carefully, and secretly, filed away for future study. In 1972, astronomers were able to deduce the directions to the events with sufficient accuracy to rule out the Sun and Earth as sources. They came to the conclusion that these gamma-ray events were "of cosmic origin". In 1973, this discovery was announced in the Astrophysical Journal.

This created quite stir in the astronomical community and dozens of papers on GRBs and their causes began appearing in the literature. Initially, most hypothesized the origin of these events came from within our own galaxy. Progress was painfully slow until the 1991 launch of the Compton

Gamma Ray Observatory. This satellite provided crucial data indicating that the distribution of GRBs is not biased towards any particular direction in space, such as toward the galactic plane or the centre of the Milky Way Galaxy. GRBs came from everywhere all around us. They are "cosmic" in origin. This was a big step in the right direction, but created more questions.

For decades, astronomers searched for a counterpart, any astronomical object coincident with a recently observed burst. But the lack of precision in the location of GRBs by the instruments of the day frustrated attempts to pin down the sources of these cosmic explosions. In 1997, BeppoSAX detected a GRB in X-rays shortly after an event and the optical afterglow was detected 20 hours later by the William Herschel Telescope. Deep imaging was able to identify a faint, distant galaxy as the host of the GRB. Within a year the argument over the distances to GRBs was over. GRBs occur in extremely distant galaxies. Their association with supernovae and the deaths of very massive stars also gave clues to the nature of the systems that produce GRBs.

It wasn't too long before the race to identify optical afterglows of GRBs heated up and new satellites helped pinpoint the locations of these after glows and their host galaxies. The Swift satellite, launched in 2004, is equipped with a very sensitive gamma ray detector as well as X-ray and optical telescopes, which can be rapidly slewed to observe afterglow emissions automatically following a burst, as well as send notification to a network of telescopes on the ground for quick follow up observations.

Today, astronomers recognize two classifications of GRBs, long duration events and short duration events. Short gamma-ray bursts are likely due to merging neutron stars and not associated with supernovae. Long-duration gamma-ray bursts (GRBs) are critical in understanding the physics of GRB explosions, the impact of GRBs on their surroundings, as well as the implications of GRBs on early star formation and the history and fate of the Universe.

Artists impression of a dark gamma-ray burst. Credit: ESO

While X-ray afterglows are usually detected for each GRB, some still refused to give up their optical afterglow. Originally, those GRBs with X-ray but without optical afterglows were coined "dark GRBs". The definition of "dark gamma-ray burst" has been refined, by adding a time and brightness limit, and by calculating the total output of energy of the GRB.

This lack of an optical signature could have several origins. The afterglow could have an intrinsically low luminosity. In other words, there may just be bright GRBs and faint ones. Or the optical energy could be strongly absorbed by intervening material, either locally around the GRB or along the line -of-sight through the host galaxy. Another possibility is that the light could be at such a high redshift that blanketing and absorption by the intergalactic medium would prohibit detection in the R band frequently used to make these detections.

In the new study, astronomers combined Swift data with new observations made using GROND, a dedicated GRB follow-up instrument attached to the 2.2-metre MPG/ESO telescope at La Silla in Chile. GROND is an exceptional tool for the study of GRB afterglows. It can observe a burst within minutes of an alert coming from Swift, and it has the ability to observe through seven filters simultaneously, covering the visible and near-infrared parts of the spectrum.

By combining GROND data taken through these seven filters with Swift observations, astronomers were able to accurately determine the amount of light emitted by the afterglow at widely differing wavelengths, all the way from high energy X-rays to the near-infrared. They then used this data to directly measure the amount of obscuring dust between the GRB and observers on Earth. Thankfully, the team has found that dark GRBs don't require exotic explanations.

What they found is that a significant proportion of bursts are dimmed to about 60–80 percent of their original intensity by obscuring dust. This effect is exaggerated for the very distant bursts, letting the observer see only 30–50 percent of the light. By proving this to be so, these astronomers have conclusively solved the puzzle of the missing optical afterglows. Dark gamma ray bursts are simply those that have had their visible light completely stripped away before it reaches us.

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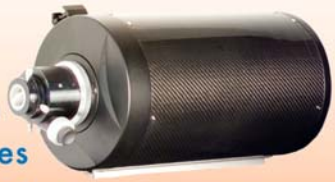

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