TAURANGA ASTRONOMICAL SOCIETY

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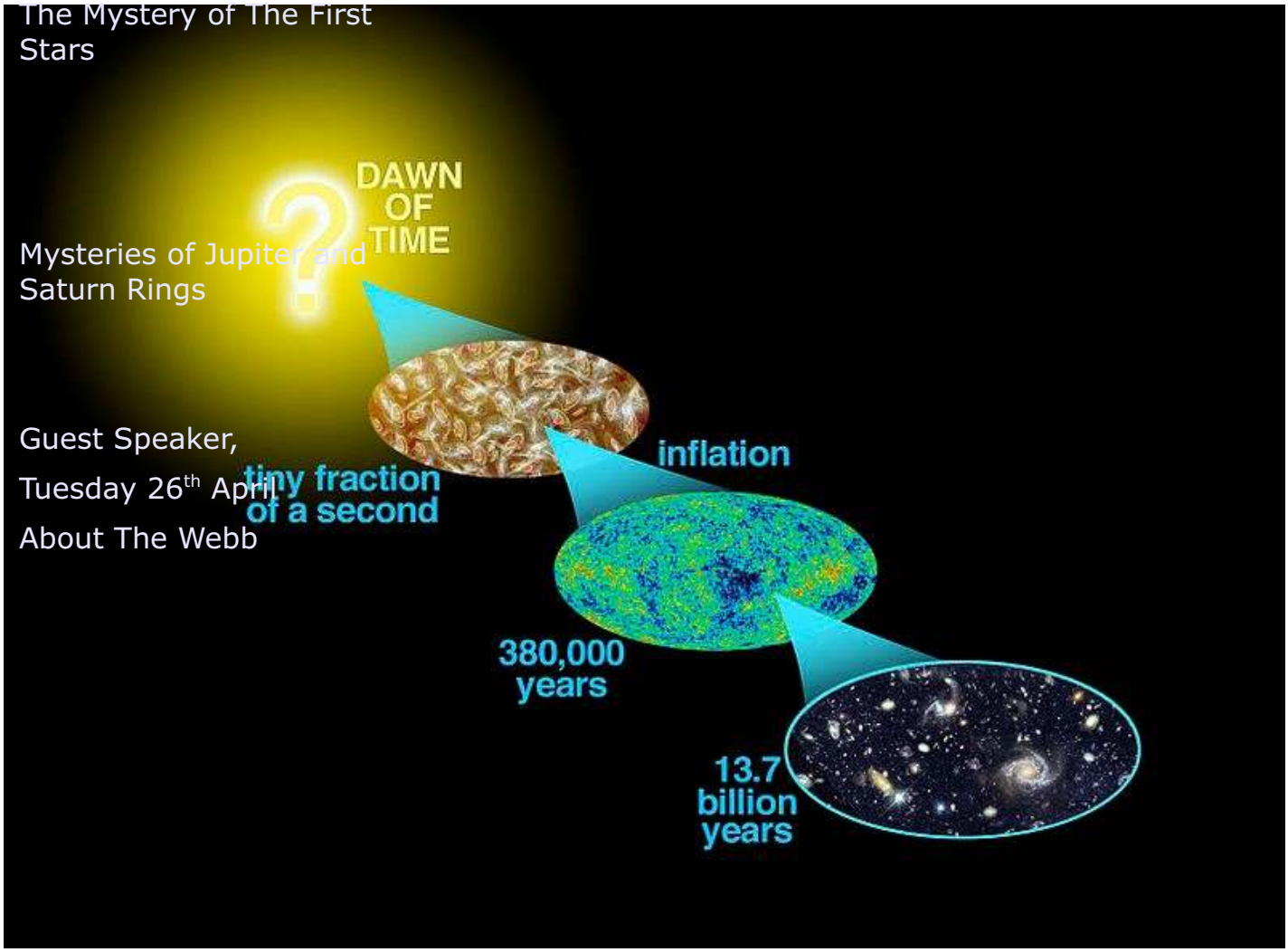
The Mystery of The First Stars

Mysteries of Jupiter and Saturn Rings

Guest Speaker,

Tuesday 26th April

About The Webb



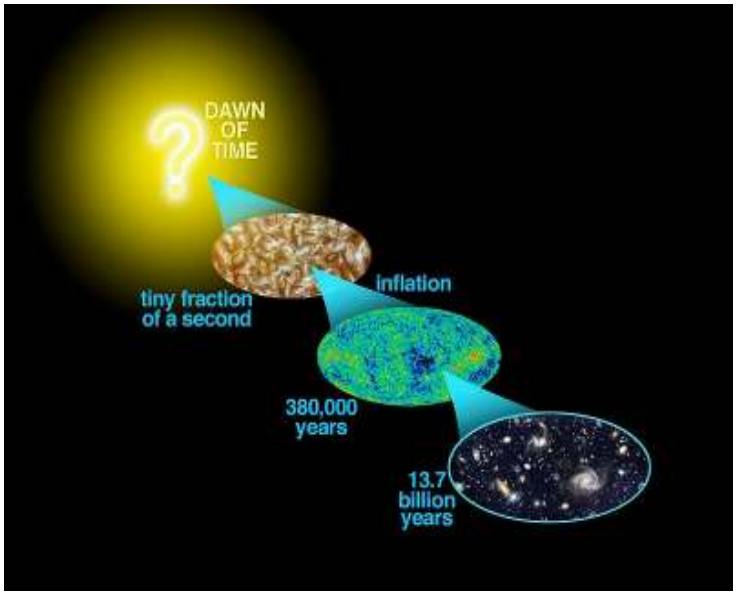
The Mystery of The First Stars

It was a delight once again to host our Patron, Dr. Grant Christie to the March "Public Invited" meeting, at the Fergusson Park observatory.
Grant opened his talk by complimenting the Tauranga Society for its up-to date facilities, as being as good as any observatory in New Zealand. He said " It just gets better every time I pay you a visit " This is a brief summary of Grant's beautifully illustrated address :

Our universe was formed some 13.7 billion years ago. We know that it took a while for the first stars to form. The stars in our galaxy are mainly gas stars. Thanks to the Hubble Telescope, we can see new stars forming in gas clouds of hydrogen, helium, and other things- including all the elements that we are made of !

Stars are born and go though a life span of various stages. They eventually swell up to become a "red giant", then shrivel to become a "white dwarf"..about the size of our Earth. 75% of the stars in our galaxy are red dwarfs. Stars, as they die, shed a lot of dust.
Supernovas explode with massive force, and leave behind "black holes".

The earliest time in our universe is referred by astronomers as "The Dark Ages". Just 1 second after the "Big Bang", protons and neutrons form. The temperature is just over 10 million degrees!. About 15 minutes later, these protons and neutrons had combined, to form helium. 380,000 years later, the universe condenses into a "dark mass". The first stars were formed 200 million years later.



When our universe was just 380,000 years old it was composed of 63% dark matter, 12% atoms, 15% protons and 1% neutrons. Today the universe is formed of 72% dark energy, 23% dark matter, and 4.6% atoms.

In the beginning of the "Dark Ages" electrically neutral hydrogen gas filled the universe. As stars formed, they ionised the regions immediately around them,creating bubbles, here and there. Eventually these bubbles merged together, and intergalactic gas became entirely ionised.

New telescopes, such as the James Webb Astronomical Telescope (JWST) and the Wilkinson Microwave Anisotropy Probe (WMAP) will enable astronomers to look back far earlier in time...
The James Webb A.T is a large, infrared optimised space telescope that is designed to study the formation of the first stars and galaxies and their evolution. The planned launch will be in 2014, with a life span of 5 to 10 years.

Its primary mirror is 6.5 metres in diameter, with a focal length of 131.4 metres.

The Wilkinson MAP measures the remaining properties of microwave radiation, following the Big Bang, over the full sky, and was launched in June 2001. After 9 years in orbit it is now described as being in a "graveyard " decline.

Other massive telescopes are the European Southern Observatory (ESO) located in the Atacama Desert in Chile. This VLT (Very Large Telescope) consists of four 8.2 metre diameter optical mirrors, plus another four 1.8 metre movable mirrors, giving an equivalent light capture of 45 metres..

In 2018 the Giant Magellan telescope will be operating from a high altitude (8,500 ft) site in northern Chile. It will be 24.5 metres in diameter (80 feet) and will be able to produce images 10 times sharper than Hubble Space Telescope.

Mysteries of Jupiter and Saturn Rings

Like forensic scientists examining fingerprints at a cosmic crime scene, scientists working with data from NASA's Cassini, Galileo and New Horizons missions have traced telltale ripples in the rings of Saturn and Jupiter back to collisions with cometary fragments dating back more than 10 years ago.
The ripple-producing culprit, in the case of Jupiter, was comet Shoemaker-Levy 9, whose debris cloud hurtled through the thin Jupiter ring system during a kamikaze course into the planet in July 1994. Scientists attribute Saturn's ripples to a similar object -- likely another cloud of comet debris -- plunging through the inner rings in the second half of 1983. The findings are detailed in a pair of papers published online in the journal *Science*.

"What's cool is we're finding evidence that a planet's rings can be affected by specific, traceable events that happened in the last 30 years, rather than a hundred million years ago," said Matthew Hedman, a Cassini imaging team associate, lead author of one of the papers, and a research associate at Cornell University, Ithaca, N.Y. "The solar system is a much more dynamic place than we gave it credit for."

From Galileo's visit to Jupiter, scientists have known since the late 1990s about patchy patterns in the Jovian ring. But the Galileo images were a little fuzzy, and scientists didn't understand why such patterns would occur. The trail was cold until Cassini entered orbit around Saturn in 2004 and started sending back thousands of images. A 2007 paper by Hedman and colleagues first noted corrugations in Saturn's innermost ring, dubbed the D ring.

A group including Hedman and Mark Showalter, a Cassini co-investigator based at the SETI Institute in Mountain View, Calif., then realized that the grooves in the D

ring appeared to wind together more tightly over time. Playing the process backward, Hedman then demonstrated the pattern originated when something tilted the D ring off its axis by about 100 meters (300 feet) in late 1983. The scientists found the influence of Saturn's gravity on the tilted area warped the ring into a tightening spiral.

Cassini imaging scientists got another clue when the sun shone directly along Saturn's equator and lit the rings edge-on in August 2009. The unique lighting conditions highlighted ripples not previously seen in another part of the ring system. Whatever happened in 1983 was not a small, localized event; it was big. The collision had tilted a region more than 19,000 kilometers (12,000 miles) wide, covering part of the D ring and the next outermost ring, called the C ring. Unfortunately spacecraft were not visiting Saturn at that time, and the planet was on the far side of the sun, hidden from telescopes on or orbiting Earth, so whatever happened in 1983 passed unnoticed by astronomers.

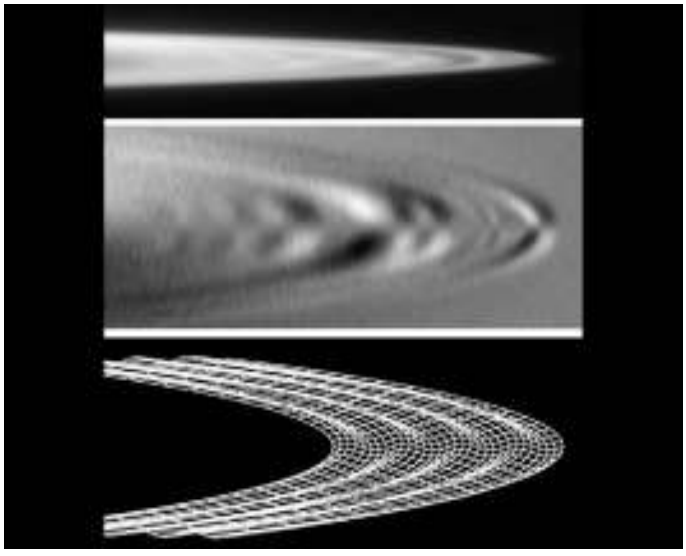
Hedman and Showalter, the lead author on the second paper, began to wonder whether the long-forgotten pattern in Jupiter's ring system might illuminate the mystery. Using Galileo images from 1996 and 2000, Showalter confirmed a similar winding spiral pattern. They applied the same math they had applied to Saturn -- but now with Jupiter's gravitational influence factored in. Unwinding the spiral pinpointed the date when Jupiter's ring was tilted off its axis: between June and September 1994. Shoemaker-Levy plunged into the Jovian atmosphere during late July 1994. The estimated size of the nucleus was also consistent with the amount of material needed to disturb Jupiter's ring.

The Galileo images also revealed a second spiral, which was calculated to have originated in 1990. Images taken by New Horizons in 2007, when the spacecraft flew by Jupiter on its way to Pluto, showed two newer ripple patterns, in addition to the fading echo of the Shoemaker-Levy impact.

"We now know that collisions into the rings are very common -- a few times per decade for Jupiter and a few times per century for Saturn," Showalter said. "Now scientists know that the rings record these impacts like grooves in a vinyl record, and we can play back their history later."

The ripples also give scientists clues to the size of the clouds of cometary debris that hit the rings. In each of these cases, the nuclei of the comets -- before they likely broke apart -- were a few kilometers wide.

"Finding these fingerprints still in the rings is amazing and helps us better understand impact processes in our solar system," said Linda Spilker, Cassini project scientist, based at NASA's Jet Propulsion Laboratory, Pasadena, Calif. "Cassini's long sojourn around Saturn has helped us tease out subtle clues that tell us about the history of our origins."



Subtle Ripples in Jupiter's Ring: These images, derived from data obtained by NASA's Galileo spacecraft, show the subtle ripples in the ring of Jupiter that scientists have been able to trace back to the impact of comet Shoemaker-Levy 9 in July 1994. (Credit: NASA/JPL-Caltech/SETI)

Guest Speaker, Tuesday 26th April

John Drummond, Astro-photographer

John Drummond has been obsessed with the stars ever since his mother pointed the 'Pot' in Orion out to him when he was 12. He also began to develop an interest in photography about the same time and later combined the two to become an amateur astrophotographer.

His other astronomical passions are comet and meteor observing and also searching for exoplanets using gravitational microlensing.

John is currently the director of two Royal Astronomical Society of New Zealand sections: the Comet and Meteor section, and the Astrophotography section. He is a Contributing Photographer for the *Australian Sky and Telescope* magazine.

John is the vice-president of the Gisborne Astronomical Society and is fairly frequently asked to speak throughout New Zealand.

He lives on a small farm with a dark sky 15 kilometres to the west of Gisborne, New Zealand and is imaging and observing on most fine nights.

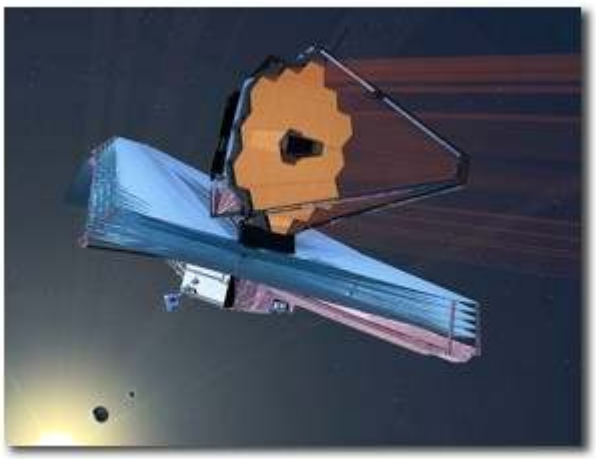
John is a school teacher by day and enjoys surfing the fantastic waves of Gisborne and also practicing martial arts. His website is www.possumobservatory.co.nz

About The Webb

The James Webb Space Telescope (sometimes called JWST) will be a large infrared telescope with a 6.5-meter primary mirror. Launch is planned for no sooner than 2014.

The Webb will be the premier observatory of the next decade, serving thousands of astronomers worldwide. It will study every phase in the history of our Universe, ranging from the first luminous glows after the Big Bang, to the formation of solar systems capable of supporting life on planets like Earth, to the evolution of our own Solar System.

Webb was formerly known as the "Next Generation Space Telescope" (NGST); it was renamed in Sept. 2002 after a former NASA administrator, James Webb.



Webb is an international collaboration between NASA, the European Space Agency (ESA), and the Canadian Space Agency (CSA). The NASA Goddard Space Flight Center is managing the development effort. The prime contractor is Northrop Grumman; the Space Telescope Science Institute will operate Webb after launch.

Several innovative technologies have been developed for Webb. These include a folding, segmented primary mirror, adjusted to shape after launch; ultra-lightweight beryllium optics; detectors able to record extremely weak signals, microshutters that enable programmable object selection for the spectrograph; and a cryocooler for cooling the mid-IR detectors to 7K. The long-lead items, such as the beryllium mirror segments and science instruments, are under construction. All mission enabling technologies were demonstrated by January 2007. In July 2008 NASA confirmed the Webb project to proceed into its implementation phase, and the project conducted a major mission review in March 2010.

There will be four science instruments on Webb: the Near InfraRed Camera (NIRCam), the Near InfraRed Spectrograph (NIRSpec), the Mid-InfraRed Instrument (MIRI), and the Fine Guidance Sensor Tunable Filter Camera (FGS-TFI) . Webb's instruments will be designed to work primarily in the infrared range of the electromagnetic spectrum, with some capability in the visible range. It will be sensitive to light from 0.6 to 27 micrometers in wavelength.

Webb has four main science themes: The End of the Dark Ages: First Light and Reionization, The Assembly of Galaxies, The Birth of Stars and Protoplanetary Systems, and Planetary Systems and the Origins of Life.

Fast Facts

The James Webb Space Telescope (sometimes called JWST) is an orbiting infrared observatory that will complement and extend the discoveries of the Hubble Space Telescope, with longer wavelength coverage and greatly improved sensitivity. The longer wavelengths enable the Webb telescope to look much closer to the beginning of time and to hunt for the unobserved formation of the first galaxies, as well as to look inside dust clouds where stars and planetary systems are forming today.

Proposed Launch Date:	2014
Launch Vehicle:	Ariane 5 ECA
Mission Duration	5 - 10 years
Total payload mass:	Approx 6200 kg, including observatory, on-orbit consumables and launch vehicle adaptor.
Diameter of primary Mirror:	~6.5 m (21.3 ft)
Clear aperture of primary Mirror:	25 m^2
Primary mirror material:	beryllium
Mass of primary mirror:	705 kg
Focal length:	131.4 meters
Number of primary mirror segments:	18
Optical resolution:	~0.1 arc-seconds
Wavelength coverage:	0.6 - 28 microns
Size of sun shield:	21.197 m x 14.162 m (69.5 ft x 46.5 ft)
Orbit:	1.5 million km from Earth at L2 Point
Operating Temperature:	under 50 K (-370 °F)

Mission Goals

- Search for the first galaxies or luminous objects formed after the Big Bang.
- Determine how galaxies evolved from their formation until now
- Observe the formation of stars from the first stages to the formation of planetary systems
- Measure the physical and chemical properties of planetary systems and investigate the potential for life in those systems

Instruments

- Near Infrared Camera (NIRCam)
- Near Infrared Spectrograph (NIRSpec)
- Mid Infrared Instrument (MIRI)
- Fine Guidance Sensors (FGS)
-

Scale model of telescope

Major Innovations

- Lightweight optics
- Deployable sunshield
- Folding segmented mirror
- Improved Detectors
- Cryogenic actuators & mirror control
- Micro-shutters

Around the Observatory

Automation of the observatory roof should be completed by the middle of April. A team led by Rob Wakefield from Contract Mechanical Services in Mount Maunganui have been working to fit a dual drum rope winch, reversing motor and limit switches to the roof opening.

A critical component is a micro-switch that's fitted to the underside of the 14 inch Meade, which prevents the roof closing while the telescope is in the "up mode". The controls are located on a box beside the roof locking pin. Funding for the project has been made possible thanks to a successful application to Pub Charity, for just under $6,000.00.

As mentioned earlier it was great to have Grant Christie visit us again, and we took the opportunity to ask him to help "fine tune" the alignment of the telescope, to get it tracking error free. Work also continues to make the telescope " remote controllable" so that what ever it's looking at in the night sky can be projected onto the large screen in the hall.

AGM 24 May

Write this important date in your calendar.
We are looking for new committee members, two of our committee are stepping down.

We would love to have some younger members on board, who would like to be part of an innovative team of astronomers who love to search the night sky.
Our observatory is open on the second and fourth tuesday of every month, we welcome you to come along on any of those nights to look through our new 14 inch meade telescope(weather permitting). The Observatory is also open on request for visitors and school groups on the second Tuesday of the month, from 7.30pm.

A special night is planned in June for members who own telescopes. If there is enough interest, we could perhaps move down to the boat ramp, where its a lot darker.

BACK PAGE

The Tauranga Astronomical Society holds a monthly meeting on the fourth Tuesday of each month at the Otumoetai Sport and Recreation Club, Fergusson Park, Tilby Dr, Matua. The meeting begins at 7.30pm and all are welcome.

New comers are invited to attend two meetings free of charge, however, after this a charge of $5.00 per meeting will apply if membership of the society is not taken up.

Current membership fees are below and may be paid to the treasurer on any club night.

Full Time Student	$15
Ordinary Membership	$20
Family	$30

Meetings consist of a presentation of roughly one hour either by a society member or an invited guest on an astronomical subject. After light refreshments this is followed by viewing through one of the society's telescopes, including our new Meade, weather permitting, or the screening of an Astronomical DVD.

The Tauranga Astronomical Society Newsletter is published quarterly each January, April, July and October. Our editors welcome contributions from members provided they are on an Astronomy related subject and are original. Articles for the newsletter may be submitted electronically by email to: sabelcher@value.net.nz

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