The PRETORIA CENTRE

of the

Astronomical Society of Southern Africa

www.pretoria-astronomy.co.za

NEWSLETTER NOVEMBER 2008

The next meeting of the Pretoria Centre will take place at Christian Brothers College, Pretoria Road, Silverton, Pretoria

Date and time Wednesday 26 November at 19h15
Chairperson Percy Jacobs
Beginner's Corner "The Earth is Flat - An Exercise in Perspective" by Neville Young
What's Up in the Sky? Wayne Mitchell

++++++++++ LEG BREAK - Library open ++++++++++++

MAIN TALK

TOPIC: "Leonardo da Vinci's telescope" *

PRESENTER: Prof Andrè Buys

The meeting will be followed by tea/coffee and biscuits as usual.
The next observing evening will be held on Friday 21 November at the Pretoria Centre Observatory, which is also situated at CBC. Arrive anytime from 18h30 onwards.

***This will be a follow-up of his previous presentation on the same topic.**

CONTENTS OF THIS NEWSLETTER

Last month's meeting - by Tony Viljoen

Beginner's Corner was "Making a 6" Dobsonian Telescope" by Pat Kuhn. Pat's interest was sparked 2 years ago when he read about astronomy and making your own telescope. He went to Scopex and got very enthused about the subject. So he joined Johan Smit's telescope making class and began building the default telescope, a 6" F/8 of focal length 6x150 mm or 1,2 m. Starting with the mirror, he was issued with two glass discs of 25 mm thickness and some grits. With 80 grit, the two discs were flattened against one another, and then with 'diligent' action the one was made to be convex (the tool) and the other convex to become the mirror. This was carried on until the depth of the convex one was sufficient to correspond to the correct focal length. Using successively finer grits the surface was refined to a patina and finally a glossy finish. He mentioned a few "challenges", one of which was a scratch which necessitated going back a few grits. He then carried out the final polishing with a pitch lap, and parabolised the mirror and Focault tested it to an accuracy of 1/8th wave. Finally the mirror was aluminium coated.
Pat's telescope tube and mount was beautifully made. There are trim rings at the top of the tube, and the secondary mirror has a special ball mount ingeniously made from hardware store parts. The focusser is of the helical J Smit 'patent' type. The rocker box bearings are of milk bottle 'teflon' and the ground board bearings act on a classical 78 vinyl record.

Johan Smit's What's Up was a very interesting talk, ending with an explanation of celestial co-ordinates and how to find some objects from the ASSA top 100 from their co-ordinates.

The Main Talk was given by Gil Jacobs with the subject "The Longitude Problem". In sailing vessels of the 18th century many ships and lives were lost due to the longitude problem. Longitude and latitude gives one's position on the earth. Meridians of longitude are great circles containing the centre of the earth. The prime meridian passes through Greenwich. Finding one's latitude is no problem. From measuring the sun's altitude at it's highest position, it is easy to obtain your latitude. The method of navigating before longitude could be accurately determined was by travelling north or south to the required latitude and then travelling east or west to you destination. This was a clumsy long way to navigate and since your longitude was not known, it was dangerous. The difference in time between Greenwich and your local time at 15 degrees per hour is your longitude. Local time could be obtained by sextant observations. The time when the sun is at maximum altitude is your local noon. Two accurate clocks were required, one with local time and one with Greenwich time.

In 1714 the English Parliament established a body called the Board of Longitude, and it offered the following prizes for accuracy of navigation:

10000 pounds sterling - 60 nautical mile accuracy (ie.1 degree, 4 mins)
15000 pounds sterling - 40 nm,(2/3 degree, 2 mins 40 secs)
20000 pounds sterling - 20 nm (1/3 degree, 1 mins 20 secs)

There were two viable solutions: either an accurate, reliable clock which could operate on a ship, or else the use of the moon against a stellar background, as a clock. A pendulum clock could not keep time on a ship. For the astronomical solution, an accurate prediction of the moon's position is needed. The first Astronomer Royal, John Flamsteed, produced maps with accurate star positions. The second Astronomer Royal, Edmund Halley, produced an accurate prediction of the moon's movement. Instruments used to measure celestial positions were the Double Reflecting Quadrant(<2 arc minutes) in 1731, and the sextant in 1757, which is more accurate. Tobias Mayer used Euler's theories to produce a lunar prediction to less than 1 degree (60 nm). Neville Maskelyne produced a Nautical Almanac in 1767 and he became known as the "Seaman's Astronomer". To work out time from the moon's distance from the sun, the change in semi-diameter of the moon and sun need to be known because of their elliptical orbits. Also, the moon's parallax (difference in position from centre of earth and observation position) needs to be taken into account. From the best of these tables and accurate position measurements eventually an accuracy of 15 nm was obtained.

The first developer of chronometers was John Harrison (1693-1776), and he built a series of clocks, the H1 to H5 over his lifespan of ever increasing accuracy. H1 was produced in the 1730's, and had a double barbell pendulum. H2 was made in 1739, but not taken to sea, as Harrison was not satisfied. H3 was produced in 1759 and he was awarded the Copley Medal for it. H4 in 1760 had a spring and balance wheel arrangement moving at 5 times a second. It was taken to Jamaica in 1761 and produced an accuracy much better than the Longitude Prize required. Another trip to Barbados in 1764 was made (producing an accuracy of 39 seconds, equivalent to 16 km distance in longitude) but still the Board was not satisfied, as they favoured the astronomical method. Eventually George III said "By God, Harrison, I will see you righted" and forced the board to pay Harrison most of the prize. These prizes made one the equivalent of a multi-millionaire today.

Editor's comment: I think Gil Jacobs gave us an excellent presentation.

Last month's Observing Evening - Michael Poll & Johan Smit

Well, we are running out of ways of introducing the fact that the observing evening was cloudy! There were six of us regulars there – Johan, Michael, Pat, Fred, Danie and Percy. In compensation for the cloud we *were* pleased to see the rain! We stood out of the wind, in the shelter of the pavilion, looking. We were treated by nature to a nice Sound and Light show – the lightning was rippling between the clouds creating some wonderful effects, some flashes looked like wavy lines moving along.

We mumble-mumble-moan-groaned at the lack of sky viewing opportunities, though of course, Settler's at the end of September was a good memory. Danie hoped we would not have this cloud problem at the Karoo Star Party next April!

We were supposed to have a grand evening this evening, with the learners and public from Nadine and Rookshana's Astronomy Month at UP. Johan saw some of them at the CBC gate, and gave them some hand outs and an invitation to further observing evenings.

Later, Rikus de Beer arrived as arranged, with four young potential astronomers/ telescope makers from House Jerome Place of Safety. We could not do much but say "Hello", and we promised an observing evening in Irene for the children from the home.

Our next observing evening is on November 21st. It is at the November observing evening that M31, the Andromeda Galaxy is best placed for viewing, so here's hoping….

Day trip to Tswaing crater

The Pretoria Centre plans to go on a day trip to the Tswaing crater (aka Pretoria salt pan) on Saturday March 14th 2009. Danie Barnard will be the guide and commentator. The crater is about 40 km north of Chuch Square, Pretoria. Details of times, and a route map, will be published later.

Stellar Origins - by Michael Poll

All stars begin their lives as clumps within clouds of gas and dust in the coldest and darkest places in galaxies. The Milky Way contains thousands of these dark clouds which contain developing stars. Some clouds (e.g. in Perseus and Taurus) create stars which are, at the most, a few times more massive than the sun, but larger clouds (eg in Orion) produce dense clusters of both lower and higher mass stars. There is some evidence that the sun formed in a region similar to Orion.

Stars develop everywhere in space that we look. They form mostly in spiral galaxies but they also form in dwarf and irregular galaxies. Bursts of star formation occur when galaxies collide.

The clouds from which stars form are called Giant Molecular Clouds (GMC's) – which are reservoirs of the cold, dark, gas and dust. GMC's span hundreds of light years, and can contain thousands of solar masses of material. The gas is mostly hydrogen, with trace amounts of heavier elements such as oxygen, carbon and silicon together with complex molecules such as water, carbon monoxide, ammonia, methanol, and even amino acids, which are the building blocks of proteins. So far more than 120 types of molecules have been detected in these clouds.

Radio telescopes can detect the ammonia in the clouds, and ammonia can be used as a thermometer – the strength of the ammonia emission is proportional to the temperature of the gas, and it is found that the . gas and dust in spiral galaxies is at about 10° - 50° Kelvin (K)*.
Two satellites - the Infrared Space Observatory (ISO) and the Sub millimetre Wave Astronomy Satellite (SWAS) - were launched in the 1990s to look for molecules of water. ISO looked for water in the relatively "warm" 100° - 200°K range, wh ereas SWAS looked in the 10° – 20°K range, which is only just above absolute zero. Vast quantities of water were found – for example, in the Orion Nebula water is being produced at a rate that would fill Earth's oceans once every 24 minutes. Most of water now present on Earth was created in such places.

The atoms and molecules in the clouds stick together to form dust grains which are about one micrometer (µm)** across. This dust comprises about only about 1 % of the mass of the GMC but it blocks visible and near infrared light very effectively, so that GMCs look like dark blotches surrounded by many stars. (e.g. the Coal Sack).

Stars are formed when clouds of gas and dust collapse under gravity. The gas and dust hide most of the chaos of the star forming process from view, but the clouds contain proto-stars, many of which are surrounded by accretion discs made of gas and dust left over from the star's formation.

It would be expected that the clouds would easily fall in on themselves, initiating bursts of star formation, but on scales of hundreds of light years, turbulence produces swirls in the clouds so that they do not collapse easily. Turbulence arises from internal sources such as heat and shock waves, and outside forces such as galactic rotation and supernova explosions. Magnetic pressure generated by charged particles flowing along the magnetic fields which permeate GMC's also helps prevent collapse. However, these thermal, turbulent and magnetic pressures have limits, otherwise stars would not form at all.

In the case of thermal pressures, the collapsing gas heats up and wants to expand, so the gas must cool itself for collapse to continue. It is thought that the heating is caused by collisions in the clouds - molecules and atoms absorb the energy created in contraction, and become excited to higher energy levels, and they rid themselves of this energy (and therefore of the excess heat) by re-emitting the radiation away from the cloud, and so the cloud cools. It is this radiated energy that the satellites detect. The energy released by each particular molecule is at a specific and characteristic wavelength and when the signal is analysed the source molecule can be identified. It is believed that carbon monoxide (CO) is the dominant molecule for the dispersion of the heat energy at the lowest temperatures, and that water is the coolant when the temperature reaches about 300°K.

GMC's are thus dynamic structures knotted with dense filaments and cores, but over tens of thousands of years, the knots become colder and less turbulent, and magnetic fields fade. This quiescence allows cores to continue to collapse under their own gravitational attraction to form one or more central clumps – these clumps are the building blocks of the stars. Each clump contains approximately one to several tens of solar masses of gas and dust, and is typically less than 1/6th of a light year across (this is about 160 times greater than the diameter of orbit of Neptune).

Asymmetries and turbulence in a collapsing cloud will produce a clump with a small amount of net rotation (angular momentum). This rotating proto-stellar seed is held together by gravity and

heated by internal thermal pressure as the constituent particles bump into each other. As gravity makes the proto-star shrink further it spins faster in order to conserve its angular momentum. However, if all rapidly rotating material fell directly to the centre, the clump would spin up so much it would fall apart. If there was no way to shed this excess spin, only stars with a mass of about 0.05 solar mass could ever form. The excess spin is regulated by the accretion
disc, which is the disc of gas and dust rotating around the proto-star. The accretion disc is approximately 100 – 1000 astronomical units (AU)*** in diameter.

The disc regulates the angular momentum by allowing slow spinning material to accrete on to the proto-star while directing fast spinning material out of the system in powerful polar jets (which are perpendicular to the disc). Nearly 400 proto-stars with bipolar outflows have been found. There is an ionized jet at the central axis of each outflow which travels at velocities of more than 100 km per second, and the jet is typically surrounded by a broader gas bubble forming a shell and moving at a few tens of km per second. The bipolar outflows blast their way through the molecular cloud and into interstellar space, and can extend out from 3 – 30 light years. The interaction of the bi-polar outflow with the interstellar gas creates objects known as Herbig-Haro objects.

A physical link between the inflow to the disc and outflow through the jet has not yet been found because current telescopes cannot see what is happening immediately around the proto-star. Theoretical models are used to try to explain how the disc regulates accretion and how the jet outflow is launched. The key ingredient is magnetic fields threading through the disc – they help lift rapidly rotating ionized material off the top and bottom surfaces of the disc and fling it away. Gravity then becomes stronger than the centrifugal force, allowing the decelerated material left in the disc to accumulate on to the proto-star.

It is not clear how the disc material is loaded onto the magnetic field lines to be cast outward. Localised heating and turbulent eddies may help lift fast spinning gas above the disc surface where it is ionized by the proto-star's radiation and shock fronts. The ionized gas then moves out along the magnetic field lines, and carries away the angular momentum. Models predict that the remaining gas in the disc now spins more slowly because the out flowing gas drains the disc of angular momentum.

The ionized jets of gas are also rotating. If it is assumed that speed of rotation matches the speed of the rotation of the disc, the velocities involved suggest that the spray is being removed from the *disc* at about 0.03 - 2 AU from the star. In the case of the sun this would be about from the region where the Earth and other rocky planets formed. It is queried whether there is a link between location of the turbulent base of a fast moving jet and the formation of rocky planets and/or can planets only begin to form after accretion and outflow are finished? This cannot be resolved with current technology.

A solar mass star builds up slowly over tens of millions of years by gathering material from the rotating disc. Eventually the jets and radiation from the growing proto-star clear away the surrounding cloud until little gas is left, so that after a few million years, accumulation and ejection slow to a trickle. The proto-star contracts over next 100 million years, and core pressure and temperature increase until it is hot enough to ignite hydrogen fusion in the centre – a star is born. The remnant accretion disc of gas, dust and rocky pebbles eventually form a planetary system
As well as for sun like stars, this picture of star formation also holds for low mass stars (0.1 solar masses, = 100 Jupiters). Even brown dwarfs (15 – 75 Jupiter masses) appear to form in much the same way, as do smaller 5 Jupiter size objects.

*0° Kelvin = - 273.16℃ 273.16°K = 0℃
**1000 ($10^{3)}$ nanometres (nm) = 1 micrometer (µm) = 10^{-3} mm = 10^{-6} metres
*** Astronomical Unit (AU) 1 AU = the average distance from the Sun to the Earth

References

Molecules of Life in Space. Steve Nadis. Sky & Telescope, January 2002, page 32.

From the Cold Depths of Space. Debra Shepherd. Sky & Telescope, June 2007, page 26.

NASA plans to return to the moon

The Lunar Reconnaissance Orbiter (LRO) is the first mission in NASA's planned return to the moon. LRO will launch April 24, 2009, with the objectives to finding safe landing sites, locate potential resources, characterize the radiation environment and test new technology. The return to the moon will enable the pursuit of scientific activities that address our fundamental questions about the history of Earth, the solar system and the universe -- and about our place in them. It will allow us to test technologies, systems, flight operation and exploration techniques to reduce the risk and increase the productivity of future missions to Mars and beyond. It will also expand Earth's economic sphere to conduct lunar activities with benefits to life on our home planet.

LRO is an unmanned mission to create the comprehensive atlas of the moon's features and resources necessary to design and build a lunar outpost. LRO focuses on the selection of safe landing sites, identification of lunar resources and the study of how lunar radiation will affect humans. **http://www.nasa.gov/mission_pages/LRO/overview/index.html**

Book by Andrè du Preez

Attention is drawn to a book by one of our members, Andre du Preez, presented as a "general theory on cosmic dynamics", and having as its central theme a "multiversal cosmic structure" as the generator of cosmic acceleration. Also addressed, are cosmic life, time/age, cosmic velocities, the ultimate variables and an eventual cosmic demise.

The book, which can be viewed at our library, sells at R75.00. Interested members can contact Andre at tel. 012 345 1430 or cell. 071 059 4761or e-mail .**hanniedp@telkomsa.net**

Observatory for sale

Mauritz Geyser has relocated to the Cape and has decided to sell his observatory. The buyer will have to dismantle and move the observatory.

http://www.etacarina.co.za/observatory/obs4sale.htm

Asking price: R4700 onco. For more info please contact Mauritz at 082 824 0152.

Space shuttle missions

The space shuttle mission to repair and upgrade the Hubble Space Telescope (HST) has been delayed. Mission managers were aiming for a February 2009 launch for the fifth and final shuttle mission to the HST. Now NASA is aiming for a May 2009 launch.

The launch date for the space shuttle mission to the International Space Station was set for November 14, 2008.

http://www.universetoday.com/2008/10/30/hubble-servicing-mission-delayed-mission-to-iss-set-for-nov-14/

THERE WILL BE NO NEWSLETTER, NO MONTHLY MEETING AND NO OBSERVING EVENING IN DECEMBER. A COPY OF *"SKY GUIDE AFRICA SOUTH 2009"* WILL BE SENT TO EACH MEMBER AS SOON AS THEY ARE RECEIVED FROM THE PUBLISHERS.

Hottest Planet Ever Discovered

A planet called WASP-12b is the hottest planet ever discovered (about 2200 degrees Celsius), and orbits its star faster and closer in than any other known world.

This sizzling monster whips its way around its parent star about once a day. For comparison, the fastest-circling planet in the solar system, Mercury, orbits the Sun once every 88 days.

To make such swift progress, the planet circles extremely close in to its star — about 2 percent of the distance from the Earth to the Sun, or about 3 million kilometers.

It was discovered by one of the two SuperWASP telescopes. The image shows an artist's impression of a scorching extrasolar planet looming close to its parent star in the background.

http://www.livescience.com/space/hottest-planet.html

Collision of galaxy clusters

A powerful collision of galaxy clusters has been captured by NASA's Hubble Space Telescope and Chandra X-ray Observatory. The observations of the cluster known as MACS J0025.4-1222 indicate that a titanic collision has separated the dark from ordinary matter and provide an independent confirmation of a similar effect detected previously in a target dubbed the Bullet Cluster. These new results show that the Bullet Cluster is not an anomalous case. This clash of clusters provides striking evidence for dark matter and insight into its properties.

http://hubblesite.org/newscenter/archive/releases/2008/32/

Astronomy Starter Package CD and IYA Resources CD

Copies of the **Astronomy Starter Package CD** will be offered for sale at the meeting on 26 November. This CD was discussed at the August meeting by Percy Jacobs. Of the 23 CD's we had available for sale at that meeting, all were sold immediately. They cost only R50 each. It is definitely worth the money. Apologies for them not being available at the last meeting.

There are still a few copies of the **IYA Resources CD** available. They are available for free to members who have not yet obtained one.

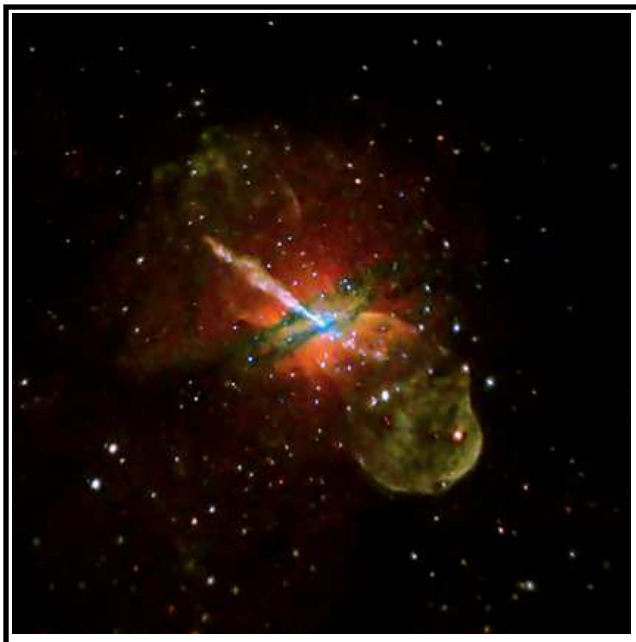
National Geographic magazine

- There is an article on light pollution in the November issue, page 102.
- A special edition about space will soon be issued. Watch the shelves at CNA.

National Star Party

The Pretoria Centre of the ASSA wants to have the first National Star Party in South Africa during the weekend of 25 to 27 April 2009 about 20 km north of Britstown in the Karoo. The Karoo sky is fabulous there. Danie Barnardo, one of our committee members, is the driving force behind this venture. This will form part of the activities for IYA2009. See our Centre's website for more details.

New view of Centaurus A



A dramatic new Chandra image of the nearby galaxy Centaurus A provides one of the best views to date of the effects of an active supermassive black hole. Opposing jets of high-energy particles can be seen extending to the outer reaches of the galaxy, and numerous smaller black holes in binary star systems are also visible.

The image was made from an ultra-deep look at the galaxy Centaurus A, equivalent to more than seven days of continuous observations. Centaurus A is the nearest galaxy to Earth that contains a supermassive black hole actively powering a jet.

A prominent X-ray jet extending for 13,000 light years points to the upper left in the image, with a shorter "counterjet" aimed in the opposite direction.

http://chandra.harvard.edu/photo/2008/cena/

Terrestrial Planet Finder

The **Terrestrial Planet Finder** (TPF) will use a small collection of high sensitivity telescopes (probably 4 large 3.5-meter telescopes) with revolutionary imaging technologies. It will measure the temperature, size, and the orbital parameters of planets as small as our Earth in the habitable zones of distant solar systems. Also, TPF's spectroscopy will allow atmospheric chemists and biologists to use the relative amounts of gases like carbon dioxide, water vapour, methane and ozone to find whether a planet might support life. Launch is anticipated between 2012-2015.

A great challenge is how to detect planets against the blinding glare of their parent star. TPF with 4 big telescopes, will reduce the glare of parent stars to see planetary systems up to 50 light-years away. The image is an artist's depiction of two different proposed designs for TPF, one on the left and another on the right.

http://www.terrestrial-planet-finder.com/

http://space.about.com/cs/nasanews/a/tpf051104.htm

Jaareindfunksie

Ons jaareindfunksie gaan 'n bring-en-braai en sterre-kyk geleentheid by Erich Nockler se kleinhoewe wees. Dit sal plaasvind op Vrydag 28 November 2008 vanaf 18:00. Bring eie kos en drank en teleskope. Erich sal aan ons pap voorsien asook elektrisiteit vir elektriese braaiers. Die roete-aanwysings is as volg.

Ry met Garstfonteinweg in 'n O-SO rigting. Ry oor Hans Strydomrylaan. Ry by Woodlands verby. Ry by Tierpoort verby. Ry verby die "Bashewa" winkel aan die linkerkant. Een km anderkant die winkel (presies 20 km verby Hans Strydomrylaan), aan die linkerkant, is Erich se kleinhoewe by Garstfonteinweg nommer 152. Erich se selfoon nommer is 083 729 8559.

Summary of "What's Up in the Sky?" to be presented on 26 November

"What's Up in the Sky?" by Wayne Mitchell on 26 November will include some of his personal favourite deep space objects, and simple ways to locate them. He will also include planetary positions. He will base the talk on pages from his star atlas which he will introduce. He will add in the ISS sightings and see what else.

Websites: **http://www.saao.ac.za/public-info/sun-moon-stars/**

http://www2.jpl.nasa.gov/calendar/

http://www.skyandtelescope.com/observing/highlights/19981449.html

Also: **Sky Guide Africa South 2008**.

Wayne Mitchell's star atlas

He will offer copies of it for sale at the meeting on 26 November.

Largest known exoplanet

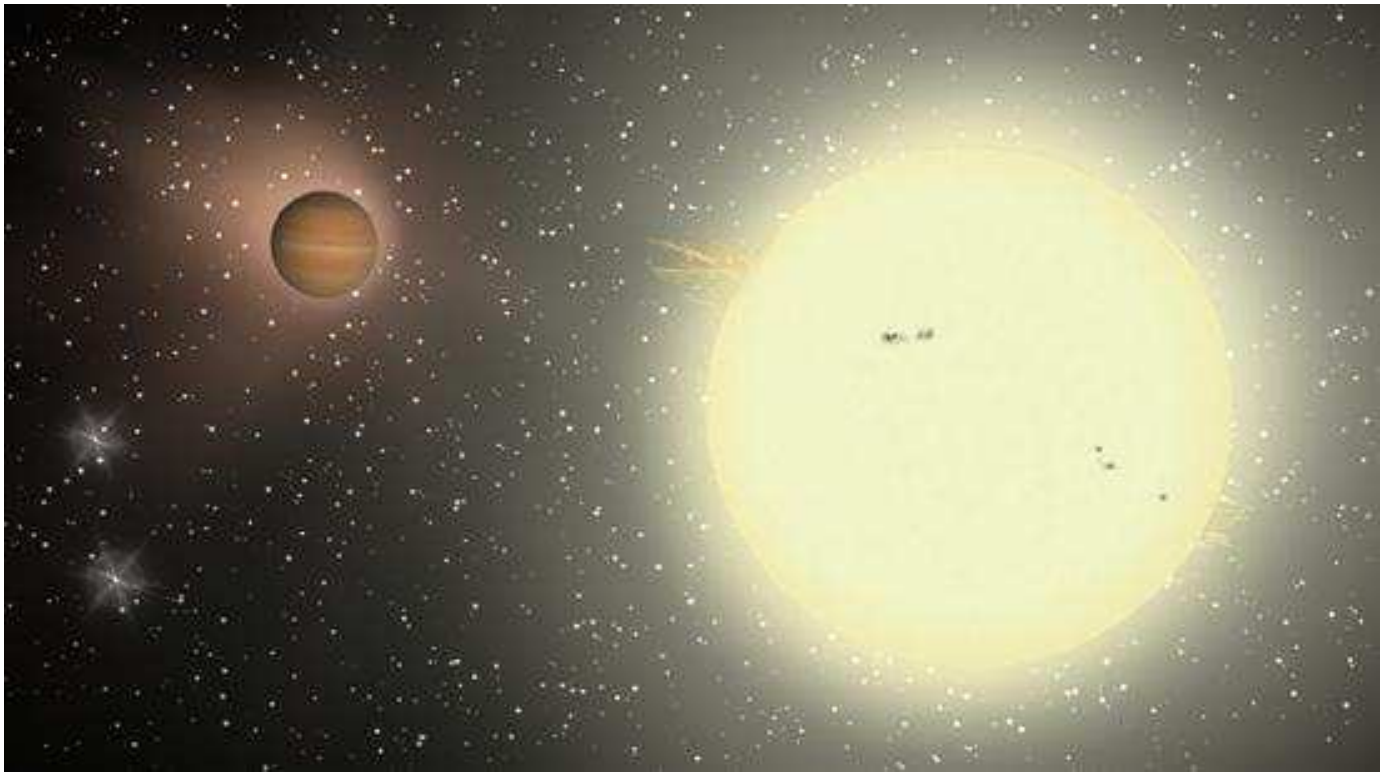
A newly discovered alien planet has a record-breaking low density - about the same as that of balsawood. Astronomers say the planet, called TrES-4, could be losing grip of its puffed-up atmosphere.

The periodic dimming of a star 1400 light years away in the constellation Hercules revealed the presence of TrES-4, which orbits the star every 3.5 days. Follow-up observations using large telescopes in Hawaii and Arizona showed that the planet is just 0.84 times as massive as Jupiter.

But the amount of dimming makes sense only if the planet is about 1.7 times as wide as Jupiter. Astronomers calculate that its average density is only about 0.2 grams per cubic centimetre.

The image is an artist's illustration of TrES-4 orbiting its parent star, which has a mass of 1.2 solar masses.

http://www.newscientist.com/article/dn12430



The Lagoon nebula

This is one of the “first light” images made by SALT. It shows the central regions of the Lagoon nebula, a.k.a. M8 and NGC 6523. It is a giant interstellar cloud, classified as an emission nebula and H II region. It resides in the constellation Sagittarius at an estimated distance of 4 100 light-years. The Lagoon nebula is one of only two star-forming nebulae faintly visible to the naked eye. At declination −24° 23′ 12″, it is visible high up in the southern sky at appropriate times.

http://en.wikipedia.org/wiki/Lagoon_Nebula

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