



The **PRETORIA CENTRE**

of the
Astronomical Society of Southern Africa

www.pretoria-astronomy.co.za

NEWSLETTER APRIL 2012

Next meeting

Venue: The auditorium behind the main building at Christian Brothers College (CBC), Mount Edmund, Pretoria Road, Silverton, Pretoria.

Date and time: Wednesday 25 April at 19h15.

Programme:

- **Beginner's Corner:** "Feedback from the Karoo Star Party"
by Danie Barnardo & Johan Smit.
- **What's Up?** by Percy Jacobs.
- 10 minute break — library will be open.
- **Main talk: "Fractals"**
by **Prof Ansie Harding.**
- Socializing over tea/coffee and biscuits.

The chairperson at the meeting will be Fred Oosthuizen.

Next observing evening: Friday 20 April at the Pretoria Centre Observatory, which is also situated at CBC. Turn left immediately after entering the main gate and follow the road. Arrive from sunset onwards.

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Summary of "What's Up?" to be presented on 25 April 2012 - by Percy Jacobs

Phases of the Moon

Full Moon	-6 th May
Last Quarter	- 12 th May (rises rises midnight)
New Moon	- 21 st May (dark sky)
First Quarter	- 28 th May (rises 12:00, sets 00:00)
Dark Sky	- from about 13 th May to 27 th May

Planets

- Mercury** - visible in morning sky as "Morning Star" in the East
 - by month end it is lost in the rising Suns glare
- Venus** - evening star in the North West
 - reaches maximum brightness mid month - ¼ to ½ phase
- Mars** - visible in the north east
 - main target for the month - try and find the polar caps if you can
- Jupiter** - starting to disappear in the west
 - too close to the sun to be seen in the month of May
- Saturn** - the main target for the month
- Uranus** - rises in the east well past midnight - ~03:00 with Pisces
- Neptune** - rises after midnight at about 01:00 with Aquarius

Regulus and Mars are a pair & Spica & Saturn are a pair. Both stars appear white, while planets have a hint of colour. Mars the most striking.

Events

Meteor Showers

- Eta Aquarids
 May 5th / May 6th - ~60/hr
 full moon in the west
 look east towards Aquarius (opposite full moon)

Constellations – shall be discussed in more detail at meeting

- Crux - "southern cross"
 Vela - "the sails" – Gamma Velorum
 Carina - "the keel" – false cross and Canopus
 Centaurus - "the centaur" – pointer stars – Alpha & Beta Centauri
 Scorpius - "the scorpion" – Antares
 Virgo - "the virgin" - Spica
 Leo - "the lion" - Regulus
 Corvus - "the crow" – Delta Corvi
 Gemini - "the twins" – Castor & Pollux
 Libra - "weighing scales" – no 1st magnitude stars
 Sagittarius - "the archer" – galactic centre

"ASSA Top 100" Observers

George Dehlen	60
Louis Kloke	31
Percy Jacobs	29
Grant Thompson	16
Pat Kühn	15
Michael Poll	12
Andre de la Ponte	6
Total	169

Observing Evening Report : March 23rd 2012 - by Michael Poll

We had a clear evening : obviously World Meteorology Day was in our favour! About 40 or so people there, mostly visitors, who were very welcome. There were some enthusiastic children as well, and lots of discussion. We had only three telescopes, (Pat, Michael and Anton) as a number of regulars were in the Karoo at Britstown.

Jupiter and Venus were putting on a splendid show in the northwest, as they had been doing for some time. All of Jupiter's moons were on one side of the planet, three in a clump and one outlier. Venus was showing a half phase, as it was only four days away from its greatest elongation east. These two planets were suitably appreciated, and even four year old Adriano picked up Jupiter's moons. The Pleiades were to the east of Venus, and were admired, although they were getting a bit low down as it is now near the end of the Pleiades viewing season. Next was M42, the Orion Nebula which was looked at with naked eye, binoculars and telescopes. The outline of the constellation was pointed out to some who were noting it for the first time, and the Belt ("Three Sisters") and the Sword were identified. The nebula was as noteworthy as ever. Mars was high in the north east, in Leo, and the stars of Leo were noted. People were prompted to watch Mars to move against the star background over the next few weeks, by noting the shape of the triangle formed by Regulus, Mars and Gamma Leonis. However, Mars' position will change slowly during April, as it (was) at its stationary point in mid April, and it will be moving eastwards when this essay is published. Telescopically Mars showed a nice reddish disc but not much surface detail was seen. In discussions about Mars it was pointed out that Mars is only bright for a few weeks every two years or so, which gives people long enough to forget how bright it can be, especially as the brightest oppositions occur only every 15 years or so.

Some telescopic favourites in the south were shown to many visitors, principally we looked at NGC 3532 (the Wishing Well Cluster, but which was a bit washed out by the sky) and IC 2602 (the Southern Pleiades) which is very striking even with the light pollution. It was noted that Theta Carinae, the brightest star in the cluster, can be seen with the naked eye – it is at the opposite end of the Diamond Cross to Beta Carinae (Miaplacidus).

We did a bit of a double, or multiple, star tour. One of the best at the moment is Gamma Velorum, with its two bright components, and then two other slightly fainter stars forming a "T". Alpha Centauri is now difficult to separate in Michael's 6 inch, but the three stars of Alpha Crucis were well seen, with the one wide split, and the tight second pair. We also looked at Castor, which was not so impressive on this night.

There was quite a bit of naked eye touring of the evening sky. The bright stars that outline the Milky Way from Alpha and Beta Centauri through Crux, and passing overhead to Orion and Taurus were noted, although the fainter background stars could not be seen. Lower in the south were the "Southern Crosses" – Crux, the Diamond Cross and the False Cross, and higher up were Sirius and Canopus. We could not see the LMC, but it was pointed out that a line from Sirius to Canopus extended half as far again locates the Cloud. It was also shown that the extension of the long axis of the Diamond Cross also points to the cloud. The norther Zodiacal constellations were noted : Taurus, Gemini, Cancer, Leo and Virgo. The outlines formed by the brighter stars were pointed out, although Cancer, the faintest of the zodiacal constellations was not visible.

Saturn came up later on, it is currently one of a pair of bright objects similar to the Regulus –Mars pair, but this time Spica was the star paired with the planet. This is the start of the evening viewing season for Saturn, and we could see that the rings are now a bit wider open. Unfortunately it was a bit late by the time Saturn cleared the trees to the east, so it was missed by some of our visitors. The planet will be higher in the sky at the April 20th observing evening, so it can be appreciated much earlier on, and hopefully those who missed it will get a chance this month to see it.

March 2012 meeting report - by Johan Smit

The meeting was attended by about 45 people, including some first time visitors. Everyone was welcomed and the following two notices were read:

- **Northern Star Party, 2012**

The Pretoria Centre of ASSA presents a Star Party during the weekend of 13 to 15 July 2012 at the Shekinah Camp in the Greater Mabula nature reserve in the Waterberg. The reserve is approximately 50 km west of Bela Bela (Warmbaths).

A bulk booking has been made in a dormitory style bungalow with bunk beds for 20 people @ R170 per person for the two nights. A communal kitchen and ablution block is available.

If you prefer the dormitory style accommodation:

All interested persons must reserve their places, together with the full payment to the Pretoria Centre bank account. A booking form will be available on the ASSA Pretoria web site. A booking will only be confirmed when full payment has been confirmed by the treasurer.

The facilities are self-catering, thus you need to bring your own food and drink, as well as bedding.

If you prefer different accommodation:

Other accommodation is also available on the site and can be booked by individuals or groups who seek more comfortable accommodation. Booking for these facilities must be made at: <http://www.shekinahkamp.co.za>. **Payment for these bookings must be made directly to Shekinah Camp.**

Reports have it that this is a really dark sky venue and since the Moon will be between last quarter and new Moon, there should be plenty of great dark skies for viewing during the weekend.

Bookings must be confirmed before 15 June 2012, but remember there are only 20 bunks available. All bookings will be on a first come first served basis.

Contact Bosman Olivier or Percy Jacobs for more information.

Their details are available on www.pretoria-astronomy.co.za

- **Scope X**

Scope X to be held on 21 July 2012. Diarise this day and complete those projects.

"Beginner's Corner", combined with "What's Up?", was presented by Michael Poll. Michael started with Jupiter that is busy disappearing from the early evening sky. In fact we are running away from Jupiter and that makes it look like Jupiter is moving westwards and will be in conjunction with the Sun on 13 May, after which it will start to become visible in the early morning.

Then he explained the relationships between Earth and Venus's orbits and why the transits of Venus happen when they do. The next one will be in June 2012, but will not be as visible from South Africa like the one in June 2004 was.

The synodic period is the time Venus takes to be seen again from the Earth in the same position with respect to the Sun (but not necessarily to the stars). It is 584 days long (583,92 days to be exact) or just over 19 months.

5 Synodic periods is just about equal to 8 Earth years and this means that every 8 years Earth and Venus will occupy the same relative positions. This points move slowly clockwise around the Sun and may happen to fall on the nodes where the plane of Venus's orbit intersects the plane of Earth's orbit relative to the sun. The nodes that favours a transit occur in June or December and there is a 3 day window in which a transit is possible. Every 105,5 years a pair of transits happen 8 years apart. The last one was in June 2004. The next one will be in June 2012, after which another pair will happen in December 2117, and again in December 2125.

If you missed the transit in 2004 and wants to see a complete one, you will need to travel far east to the east coast of Australia or New Zealand, or Japan, or Siberia and China. On our north-east coast you will only see the last few minutes of the transit at sunrise.

Then Michael explained our relationship with Mars and the occurrence of oppositions and why some are more favourable than others. These oppositions occur in July, August or September

Basics: Finding distances to stars by the moving cluster method by Pierre Lourens

This method requires a star cluster to be near enough so that its apparent angular diameter changes appreciably as it travels toward or away from us. The method is basically simple. The angular diameter of the cluster is measured at two different times and the radial velocity of the cluster determined from measurement of its Doppler shift. The distance is then calculated using the values of these quantities. A formula will now be derived for the average distance of the cluster. The derivation is simple, but members who don't like mathematics can skip the derivation and proceed directly to equation (6) below. It is assumed that the stars in the cluster are moving at the same velocity (relative to the Sun). The linear diameter of the cluster then remains constant. The symbols have the following meanings:

t : time.

Δt : a change in time, i.e., a time interval. It is measured from the time t .

Θ : apparent angular diameter of the cluster at time t .

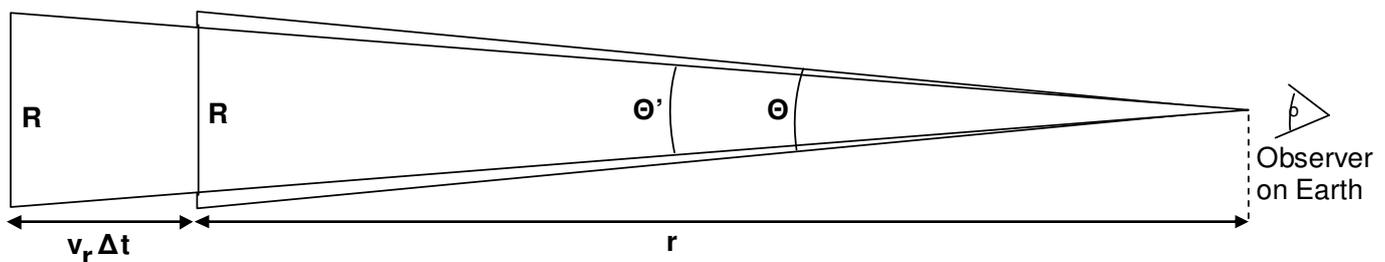
Θ' : apparent angular diameter of the cluster at time $t + \Delta t$.

R : linear diameter of the cluster.

r : average distance to the cluster at time t .

v_r : radial (i.e., line of sight) component of velocity of stars in the cluster (relative to the Sun).

$\Delta\Theta$: $\Theta - \Theta'$.



When Θ and Θ' are small angles, then we have to a good approximation for Θ and Θ' :

$$\Theta = R / r \quad \text{with } \Theta \text{ in radians} \quad (1)$$

$$\Theta' = R / (r + v_r \Delta t) \quad \text{with } \Theta' \text{ in radians} \quad (2)$$

$$\Delta\Theta = \Theta - \Theta'$$

$$= R / r - R / (r + v_r \Delta t)$$

$$\text{Then } \Delta\Theta = (R / r) (v_r \Delta t / [r + v_r \Delta t]) \quad (3)$$

Substitute R / r with Θ from equation (1) into equation (3) Get

$$\Delta\Theta = \Theta \Delta t / (r + v_r \Delta t) \quad (4)$$

Since $v_r \Delta t \ll r$, it follows from equation (4) that

$$\Delta\Theta = \Theta v_r \Delta t / r \quad (5)$$

to a very good approximation.

Solve for r from equation (5). Obtain

$$\boxed{r = \Theta v_r \Delta t / \Delta\Theta} \quad (6)$$

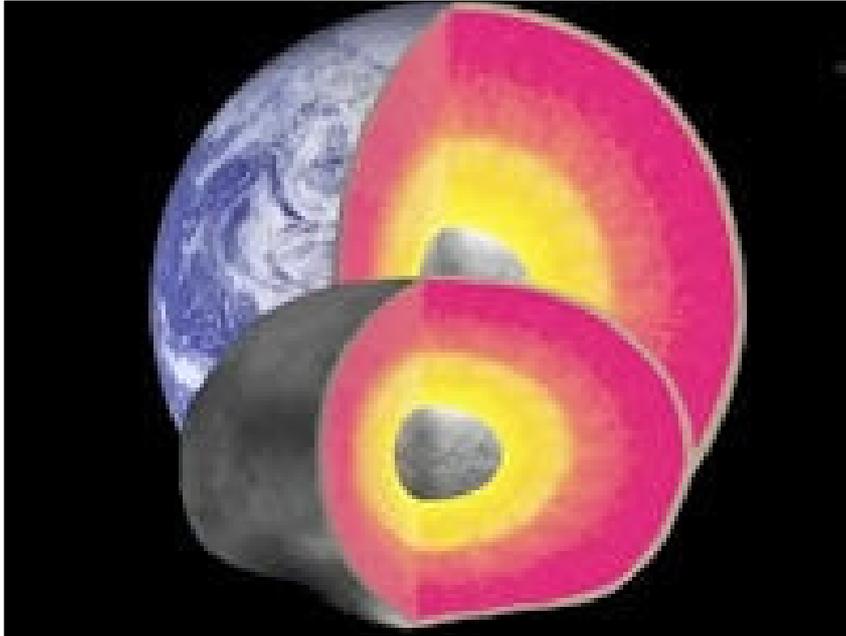
All the quantities on the right hand side of equation (6) are determined by measurement. v_r is determined by measuring the Doppler shift of the absorption lines of stars in the cluster. This shift is measured from Earth and a value for v_r is determined from the value for the Doppler shift thus obtained. However, because the Earth moves relative to the Sun, the value for v_r is corrected to obtain the value of v_r relative to the Sun. Θ and Θ' are measured at times t and $t + \Delta t$ and $\Delta\Theta = \Theta - \Theta'$. Δt is the time interval between the measurement of Θ and Θ' .

Note that r is actually the average distance to the cluster at time t , and $r + v_r \Delta t$ at time $t + \Delta t$. But, since $v_r \Delta t \ll r$, r is also the average distance to the cluster at time $t + \Delta t$, to a very good approximation. And the change in the value of r over a period as long as a century even or a thousand years is also negligible in comparison with the value of r .

Since the distance between the stars in the cluster are small in comparison with r , the distance of each star in the cluster is also r , to a good approximation.

The moving cluster method is one of many ingenious ways that astronomers have devised in order to find out things about our great, beautiful Universe.

Feature of the month: Vesta the smallest terrestrial planet



Spacecraft Dawn has been studying Vesta. Vesta has so much in common with the terrestrial planets, that it should be formally reclassified from "asteroid" to "dwarf planet". It has enormous mountains, valleys, hills, cliffs, troughs, ridges, craters of all sizes, and plains. It has an iron core and its surface features indicate that the asteroid is differentiated like the terrestrial planets Mercury, Venus, Earth and Mars, as illustrated on the image at left. A short lecture on a video clip can be seen at

<http://www.youtube.com/watch?v=JBNkts5YXA>

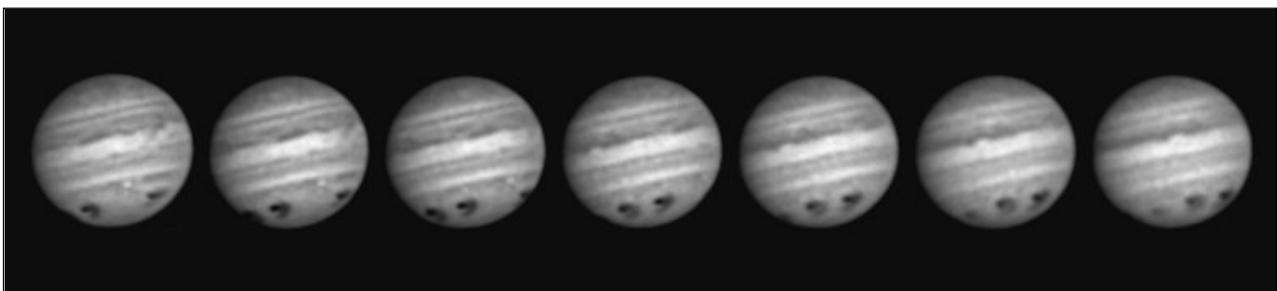
Guide to Night Skies of Southern Africa - by Peter Mack

The book is now available in English / Afrikaans.

<http://www.randomstruik.co.za/title-page.php?titleID=1402&imprintID=0>

Upcoming public lectures on astronomy

- **Mapping the Invisible Universe – Thursday 19th April 2012**
Public lecture and panel discussion by Dr Bruce Elmegreen (IBM Research Division, New York). 1pm – 3pm, Great Hall, Wits University. Contact rechelle.tsunke@wits.ac.za or phone 011 717 1193 for further enquiries.
- **New Worlds: In Search of other Earths – Thursday 19th April 2012**
The first Arthur Bleksley Memorial Lecture by Prof Debra Elmegreen (President, American Astronomical Society). 6pm in Auditorium 2, Science Stadium, Wits University. Contact rechelle.tsunke@wits.ac.za or phone 011 717 1193 for further enquiries.



Noteworthy items

- **Soar through a sea of aurorae.** See spectacular photographs taken in Norway and video clips recorded from the ISS.
<http://news.discovery.com/space/space-aurora-120319.html#mkcpgn=emnws1>
- **NASA'S Swift satellite narrows down origin of type IA supernovae.**
http://www.nasa.gov/home/hqnews/2012/mar/HQ_12-086_Swift_Typela_Origins.html
- **ELIPS (European Programme for Life and Physical Sciences in Space).** This is a the re-search programme that ESA is performing under the unique conditions found in space. Read a brochure that gives an overview of it.
http://www.esa.int/SPECIALS/ESA_Publications/SEM59F2T00H_0.html
- **Enceladus plumes and Dione as seen from spacecraft Cassini.**
http://www.esa.int/esaSC/SEMZ6YGY50H_index_0.html
- **Monster solar tornadoes discovered.** Magnetic tornadoes measuring several Earths wide have been spotted deep inside the Sun's atmosphere. <http://news.discovery.com/space/monster-solar-tornadoes-discovered-120329.html#mkcpgn=emnws1>
- **NASA's Chandra X-ray Observatory finds Milky Way's black hole grazing on asteroids.**
http://www.nasa.gov/home/hqnews/2012/feb/HQ12_049_Chandra_Black_Holes.html
- **Black hole ripped from relic galaxy.** It has a mass of 20 000 solar masses and is the only intermediate-sized black hole that has been found so far.
<http://news.discovery.com/space/black-hole-lifted-from-relic-galaxy-120215.html>
- **Rotation rate of Venus is slowing down.** Why it happens is still a puzzle.
<http://news.nationalgeographic.com/news/2012/02/120214-venus-planets-slower-spin-esa-space-science/>
- **Technology developed for astronomy used to preserve ancient books.** This will preserve the tens of thousands of books in the library of the Vatican for centuries to come.
http://www.esa.int/SPECIALS/Technology/SEM9TQAX9WG_0.html
- **Mars' whirling dust devil.** See an animation of a skinny "dust devil" on the dust-covered Amazonis Planitia region of northern Mars.
<http://www.nasa.gov/multimedia/podcasting/jpl-mro20120405.html>
- **Near-miss asteroid will return next year.** The 50m diameter asteroid has just passed Earth at a distance of 2 800 000 km, but in 2013 it will pass again at a distance of only 24 000 km.
http://www.esa.int/esaCP/SEMWTUAYLZG_index_0.html
- **21 December 2012 - not doomsday, but just another day.**
<http://www.nasa.gov/multimedia/podcasting/jpl-asteroid20120307.html>
- **NASA's twin Grail spacecraft begin collecting lunar science data.**
http://www.nasa.gov/home/hqnews/2012/mar/HQ_12-070_GRAIL_Science_Begins.html
- **The pit-chains of Mars – a possible place for life?** Depending on their origin, they might be tempting targets in the search for microbial life on Mars.
http://www.esa.int/esaSC/SEMK8FEWF0H_index_0.html

Exoplanets.

- **Billions of habitable worlds in our galaxy?** There could be tens of billions of planets in the Milky Way that exist within the habitable zones of their parent red dwarf stars.
<http://news.discovery.com/space/billions-exoplanets-milky-way-estimate-habitable-120328.html#mkcpgn=emnws1>
- **HST reveals weird new exoplanet: a water world.** GJ1214b is a super-Earth orbiting a red dwarf star. It is a water world with a thick steam atmosphere.
<http://hubblesite.org/newscenter/archive/releases/2012/13/>

- **New ultra dense planet found - astronomers baffled.** The high density of CoRoT-20b seems to defy current theories for how planets form. <http://news.nationalgeographic.com/news/2012/02/120222-new-planet-found-densest-jupiter-corot-space-science/>
- **Nine exoplanets discovered in solar system's twin.** <http://news.discovery.com/space/record-breaking-9-planet-star-system-spotted-120406.html>
- **The number of exoplanets that had been found up to 8 April 2012 was 763. (This figure is already outdated.)** <http://exoplanet.eu/>

Faster-than-light neutrino measurements.

- **ICARUS experiment contradicts controversial claim.** <http://www.nature.com/news/neutrinos-not-faster-than-light-1.10249>
<http://arxiv.org/abs/1203.3433>
- **Cause of error in experiment found and leader and spokesperson of team resign.** The cause of the faulty measurements has finally been found, after five months of round-the-clock work by the OPERA team. The Italian physicist who was leader of the team and the spokesperson for the team resigned following calls from members of the team for their dismissal. <http://news.discovery.com/space/opera-leaders-resign-after-no-confidence-vote-120404.html>

Errata - by Pierre Lourens

My description on page 7 of the March 2012 newsletter of the way astronomers determine the luminosity **L** of a star in practice, was not correct. The general way in which astronomers determine **L** when the distance **D** is known, is as follows.

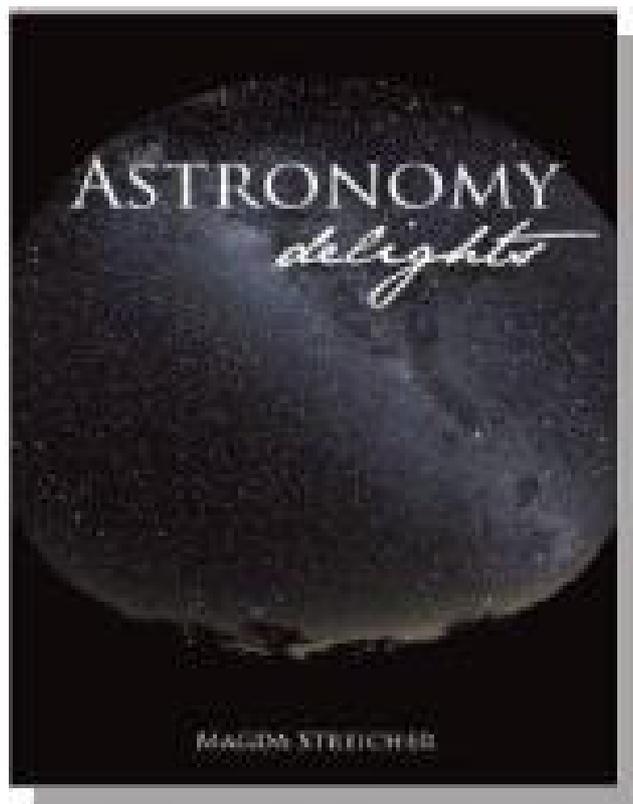
The apparent magnitude **m** of the star is measured, then the absolute magnitude **M** is calculated from it. **M** is then converted to the luminosity **L** in units of **L₀**, the luminosity of the Sun.

Thanks to Barbara Cunow for pointing out the error..

Below: An artist's depiction of an exoplanet in a close orbit around its parent star.



Above: The Cassini-Huygens spacecraft that is presently orbiting Saturn.



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The UFO Galaxy

This image of NGC 2683 (aka the UFO Galaxy) was compiled from observations made by the Advanced Camera for Surveys of the Hubble Space Telescope (HST) in visible and infrared light. It is a spiral galaxy which is located in the northern constellation Lynx at a distance of 25 ± 4 million light-years. It is fortuitously positioned edge-on. This gives scientists a great opportunity to see the delicate dusty lanes of the spiral arms silhouetted against the golden haze of the galaxy's core.

Astronomers believe NGC 2683 is a barred spiral galaxy, even though we can't see that directly. The reason why it was dubbed the UFO Galaxy is because in the HST images of the galaxy, it has the classic saucer shape of an unidentified flying object (UFO) from science fiction. When the image is turned upside down, the light from the core of the galaxy can be imagined to be some strange kind of radiation coming from an advanced propulsion system. It then resembles an UFO even more.

William Herschel discovered the galaxy on February 5, 1788.



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