SPACEWATCH
the newsletter of the Abingdon Astronomical Society

14th November 2011

Dr Frazer Pearce
(University of Nottingham)
'Exoplanets'

The nights start much earlier now and if only the clouds would move out of the way we could all do some observing. We've just moved into a new house with a nice low southern horizon – one of my (many) criteria for buying it and I'm looking forward to getting my telescope out again and doing a bit of observing, but so far it's been clouds only.

THE NIGHT SKY THIS MONTH

by Bob Dryden

Mercury: Now at greatest eastern elongation, Mercury is potentially visible in the evening sky. The problem remains one of very low altitude combined with the planet's brightness fading. You probably have about a week left of this apparition before Mercury moves too close to the Sun to be seen.
Inferior conjunction occurs on 4th December, after which the planet reappears in the morning sky quite quickly although it is not too bright yet. By 12th December it is only magnitude +0.3 but at least it is around 10° high by sunrise so scanning with binoculars should enable you to find it. By then Mercury will be low in the south east, looking like a fourth 'star' on the top of the Claw of Scorpius. Later in December thinks will improve as Mercury gains both height and brightness.

Venus: Crossing from Ophiuchus into Sagittarius this session, Venus remains quite close to the horizon. In mid-November, the planet is approximately 7° high at sunset and reaches the horizon about an hour after the Sun. By mid-December the altitude at sunset has become 10° and Venus sets around two hours after the Sun. Elongation from the Sun increases from 23° to 30° while Venus shines at a very bright magnitude -3.8. As Venus is so bright, it means you can quite easily see it despite it being low down. On the evening of 26th November a very thin crescent Moon will lie between Venus and Mercury. However, they will all be very low and will set about 30 to 45 minutes after sunset. As the sky will still be quite bright you will probably need binoculars to see this event.

Mars: Currently crossing Leo, Mars is slowly getting brighter, reaching magnitude +0.5 by mid-December. Currently quite close to Regulus (Mars will be just a few degrees to the left), the planet moves away from the bright star over the next couple of weeks. The apparent size of the disc is also increasing, growing from 6.4″ to 7.8″ this session (it will reach 14″ by the time of opposition next March). Mars rises around midnight, or just a little before by December, so telescopic observations should be made in the early morning hours once the planet has gained height. The Last Quarter Moon, Mars, and Regulus, form a nice triangle on the morning of 19th November.

Jupiter: After reaching opposition at the end of October, Jupiter is now visible for most of the night. This long period of visibility means if you fancy a marathon observing session then you can watch one complete rotation of Jupiter which takes close to 10 hours. By mid-December this observing window has just about closed because Jupiter is above the horizon for less than the required 10 hours. Over the last few years Jupiter has been crossing the southern ecliptic constellations and so has remained quite low down in the UK skies. However this is now changing with Jupiter currently in Aries. The planet now crosses the meridian much higher up and the telescopic views will be much improved. Over the next few years things get even better as Jupiter moves through Taurus and Gemini so now is the time to be practising all those observing and imaging skills. It is hard not to notice Jupiter at the moment as it is very bright at magnitude -2.8 (the brightest thing except for the Sun, Moon and Venus) but if you need a guide, on 6th December there will be a bright gibbous Moon stationed just above the planet.

Saturn: Currently a morning object in the constellation of Virgo. Rising around 2 hours before the Sun, Saturn reaches a height of 20° by daybreak. By mid-December the height becomes 30° and the planet will have been above the horizon for 4 hours by the time the Sun appears. Saturn shines at magnitude +0.7 just to the left of the bright star Spica. The rings are at an angle of 13.3°, which increases to 14.7° by December, so they will look terrific in any small telescope.

Uranus + Neptune: These two planets are nicely placed for observation now, both being visible in the evening sky. Uranus is still in Pisces and Neptune in Aquarius. Binoculars and a finder chart will reveal both planets as Uranus is magnitude +5.7 and Neptune magnitude +7.8. Make the most of the next month though as they quickly drop towards the evening twilight later in December.

Eclipse: Technically, part of a total lunar eclipse is visible on the evening of 10th December. However, unless you have a perfectly flat eastern horizon you will probably not see anything at all. This is because the umbral phase of the eclipse (the dark bit, in other words) is just coming to an end as the Moon rises over the UK. The Moon rises at approximately 15.50 UT while the umbral phase ends at 16.17 UT, so obviously there is barely 20 minutes in which to see anything – this is why you will need a completely unobstructed horizon as the Moon will be a measly 2° high at best. Of course, the eclipse is not actually over at this point because the Moon still has to cross the penumbral shadow. Unfortunately, it is very difficult to see the subtle shading of this shadow on the face of the Moon and most people cannot see it at all. All in all, this part of the eclipse is very unspectacular and usually uninteresting. The Moon finally leaves the

penumbral shadow at 17.30 UT and the eclipse is completely over.

Meteors: The Taurid meteor shower is still active until 30th November although the maximum is now past. While meteor rates will be decreasing, you may still notice a few as they are often bright and slow.

The famous Leonid shower occurs this session, although the Moon does slightly interfere. Active between November 15th and 20th, the maximum occurs on the 18th at about 08.00 UT. Leonid meteors are best looked for after midnight right up to daybreak (this year with the maximum predicted to be at 08.00 UT, rates should improve as daybreak approaches). This year the last quarter Moon rises around midnight so the sky will be rather bright throughout the best observing period. However if you position yourself so that the Moon is behind you, you will still see some meteors. The hourly rate is now much lower than it was a few years ago, with about 20 meteors an hour being predicted.

Towards the end of this session the Geminid meteor shower begins. Active from 7th December through to the 16th, this shower is an excellent one for those of us who prefer to observe in the evening rather than the morning. This is because the meteors are often bright, and often visible during the evening hours. Sadly, yet again the Moon interferes this year as it is full on the 10th December, meaning that the shower will be just about ruined as far as observing goes.

Asteroids: There are three bright asteroids to be hunted down this time.

1 Ceres, in eastern Aquarius, is fading now, going from magnitude +8.5 to mag. +9.0. This is probably your last chance to see it in binoculars this apparition.

4 Vesta is also fading as it moves from Capricornus in to Aquarius. Vesta reaches magnitude +8.0 by mid-December.

The third asteroid is **15 Eunomia** but this one is getting just a little bit brighter as it reaches opposition at the end of November. Crossing southern Perseus, Eunomia goes from mag. +8.0 to mag. +7.9 at opposition, and then fades to mag. +8.1 by mid-December.

Comets: Comet 2009 P1 Garradd continues to shine at about magnitude +7.5 in the evening sky. Still in Hercules, comet Garradd is moving very slowly and will brighten a little bit (hopefully) by early next year. It is rather diffuse, and most people are having a bit of trouble finding it in smaller binoculars – a small telescope picks it up quite easily though.

Comet P/Levy 2006 T1 reaches 9th magnitude by December (it is currently about 10th mag.). By late January it is predicted to reach 7th magnitude so this is a good chance to watch how a comet develops as it approaches the Sun. It is crossing Lacerta and moves into Pegasus at the end of November so you have plenty of time in the evening to look for it.

MOON PHASES:

Last Qtr: 18th Nov.; New: 25th Nov.; First Qtr: 2nd Dec.; Full: 10th Dec.

LAST MEETING'S TALK

by Gwyneth Hueter

We had a talk on the search for exoplanets not that long ago, but astronomical knowledge grows so quickly that we won't ever get fed up of hearing more.

Our latest tasty morsel came from Dr Peter Wheatley of Warwick University. Warning: there are some mind-boggling figures to digest.

Lest we forget how hard it is to find exoplanets he reminded us that if we viewed our Sun from a distance of one parsec (a mere 32 light-years, forget not), then Jupiter's orbit would be only half a second of arc from the Sun (for Earth, it's 0.1 arcsec). You are looking for objects ten billion times fainter that a Sun-like star, so if you try to image a planet directly it will have to be way out from its sun. Fomalhaut b is three times further out than the Kuiper Belt and images taken first in 2004 and then in 2006 show it has not moved far along in its orbit.

So, visual attempts of looking for exoplanets is not the way forward (yet?).

There are better ways to infer the existence of exoplanets:

Astrometry can show how a star and a planet revolve around a common centre of gravity, so the star will be seen to do a little wobble from a distance. Not easy. Our own solar system's centre of gravity is very close to the surface of the Sun, in spite of Jupiter's mass, and the mass of the Sun's planets. So it is so difficult to observe this 'reflex motion' of a star that the Hubble Space Telescope has to be used to observe this wobble. Hubble observing time is so precious that it can only be used to follow up stars with known planets. Dr Wheatley described SOPHIE, an extremely stable spectrograph connected to a 1.5m telescope. It observes minute Doppler shifts repeating in a star's spectrum if it has exoplanets affecting its motion. The accuracy is a few parts in 100 million. In 1995, it detected a 15 metres/sec movement in the star 51Peg, inferring that it had a planet. 51Peg b was the first exoplanet and www.exoplanet.eu shows a chart of exoplanets (4361 to Oct 10th).

Dr Wheatley can at last give us some theory on "hot Jupiter's": 51Peg b is about half the mass of Jupiter but has only a 4.2 day orbit around its star. How can a gas giant planet survive so close to its star? The theory is that as an early planet forms out of a young star's protoplanetary disc, it causes a knotting effect (distortion) of the disc and the gravitational effects of the disc make it lose mass/energy and it drifts inwards in its orbit. Computer models make the planet move rapidly into the star, so this implies that the lives of these hot Jupiters are limited. HD 10180 has multiple planets.

Another observation technique is by the transit method. A gas planet is likely to cause a drop of around 1.5% as it transits its star. The UK has built the SuperWASP (super wide angle search for planets) cameras, which consists of an array of five 11cm aperture, 200mm camera lenses (=f1.8). There are two of these, one in the Canaries, the other in South Africa, and between them they have looked

at 28.5 million stars a total of 200 billion times. They are able to detect a 1% drop in the light of a star, compared to all the other companion stars that will be in any one field (hence the need for wide angle lenses). Once you have found a dip in light you can measure the Doppler wobble.

Two amazing exoplanets are so close to their parent star that they orbit in about a day, WASP-12b and -18b. They are both hot Jupiters and are gravitationally distorted. One is losing mass into its star, the other is likely to fall into its star in just a million years. Are we seeing that one in its final stages? If so, we should see within ten years if it really is spiralling into its star.

Feel free to Google the Rossiter-McLaughlin effect to determine how planets which don't orbit their parent stars around their equators are seen in transit. There are even planets on retrograde orbits being found.

Technology also enables us to see the tiny drop in brightness as a planet goes behind its star. Infra-Red shots give the best contrast. Once you use different wavelengths to do this you can get the composition of the planet.

Dr Wheatley finally touched on finding more Earthlike planets and planets in more habitable zones. Most successful are the observations of Kepler, a NASA space telescope which has found 50 planets in habitable zones and stars with multiple transiting systems. There are two possible rocky planets, and one looks as if it is 50% water (an ocean planet?).

The next step will be the Next Generation Transit Survey (NGTS), 12 telescopes in Chile, which will study small stars (mainly K-type). Then we might be able to start looking for life, because seeing water in a spectrum is not enough. You need to see ozone, as this will indicate an oxygen-rich atmosphere. A notch at 9.5 microns in the planet's spectrum is the signature of ozone – and life is responsible for that....

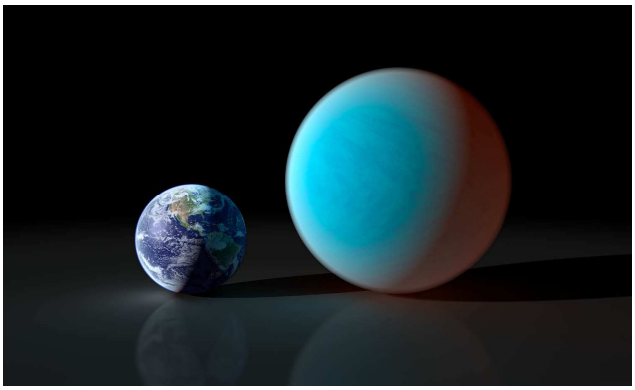
NASA Space Place

RE-THINKING AN ALIEN WORLD
THE STRANGE CASE OF 55 CANCRI E

Forty light years from Earth, a rocky world named "55 Cancri e" circles perilously close to a stellar inferno. Completing one orbit in only 18 hours, the alien planet is 26 times closer to its parent star than Mercury is to the Sun. If Earth were in the same position, the soil beneath our feet would heat up to about 3200 F. Researchers have long thought that 55 Cancri e must be a wasteland of parched rock.

Now they're thinking again. New observations by NASA's Spitzer Space Telescope suggest that 55 Cancri e may be wetter and weirder than anyone imagined.

Spitzer recently measured the extraordinarily small amount of light 55 Cancri e blocks when it crosses in front of its star. These transits occur every 18 hours, giving researchers repeated opportunities to gather the data they need to estimate the width, volume and density of the planet.



Artist's rendering compares the size Earth with the rocky "super-Earth" 55 Cancri e. Its year is only about 18 hours long!

According to the new observations, 55 Cancri e has a mass 7.8 times and a radius just over twice that of Earth. Those properties place 55 Cancri e in the "super-Earth" class of exoplanets, a few dozen of which have been found. Only a handful of known super-Earths, however, cross the face of their stars as viewed from our vantage point in the cosmos, so 55 Cancri e is better understood than most.

When 55 Cancri e was discovered in 2004, initial estimates of its size and mass were consistent with a dense planet of solid rock. Spitzer data suggest otherwise: About a fifth of the planet's mass must be made of light elements and compounds—including water. Given the intense heat and high pressure these materials likely experience, researchers think the compounds likely exist in a "supercritical" fluid state.

A supercritical fluid is a high-pressure, high-temperature state of matter best described as a liquid-like gas, and a marvelous solvent. Water becomes supercritical in some steam turbines—and it tends to dissolve the tips of the turbine blades. Supercritical carbon dioxide is used to remove caffeine from coffee beans, and sometimes to dry-clean clothes. Liquid-fueled rocket propellant is also supercritical when it emerges from the tail of a spaceship. On 55 Cancri e, this stuff may be literally oozing—or is it steaming? —out of the rocks.

With supercritical solvents rising from the planet's surface, a star of terrifying proportions filling much of the daytime sky, and whole years rushing past in a matter of hours, 55 Cancri e teaches a valuable lesson: Just because a planet is similar in size to Earth does not mean the planet is like Earth.

It's something to *re*-think about.

Get a kid thinking about extrasolar planets by pointing him or her to "Lucy's Planet Hunt," a story in rhyme about a girl who wanted nothing more than to look for Earth-like planets when she grew up. Go to http://spaceplace.nasa.gov/story-lucy.

The original research reported in this story has been accepted for publication in *Astronomy and Astrophysics*. The lead author is Brice-Olivier Demory, a post-doctoral associate in Professor Sara Seager's group at MIT.

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

FURTHER DISCUSSION

If you are not already on our internet mailing list, then why not log on to YahooGroups. The list is called 'abingdonas'. Members use the list to alert each other about celestial events and to chat about amateur astronomy. The list is quite active, with several messages most weeks. To read through previous messages click on: http://groups.yahoo.com/group/abingdonas/ .

To join the abingdonas list, please go to http://www.yahoogroups.com . You can also unsubscribe from the list here.

To post messages to the list, please send them to abingdonas@yahoogroups.com . Please note that you will need to sign up with a YahooID if you do not already have one. You can do this on the above page.

Further information about the mailing list can be found on the abingdonas webpage at : http://groups.yahoo.com/group/abingdonas/ .

Further discussion on astronomy and many other topics takes place at the Spread Eagle pub in Northcourt Road after the main meetings. You are most welcome to join us.

DATES FOR YOUR DIARY

21st Nov. – 23rd Nov. (FCN) 8pm Observing Evening at Britwell Salome. Ring Ian on the night to confirm on 07557 373401. *[FCN=first clear night]*

28th Nov. 8pm Beginners' Meeting in the Perry Room.

12th Dec. 8pm ***Stan Cocking Memorial Lecture:*** Nick Howes FRAS (Wiltshire AS) 'Solar Imaging'.

The editor of "SpaceWatch" is Andrew Ramsey, who would very much appreciate your stories & contributions. Please send any news, observations, photos, etc. to:

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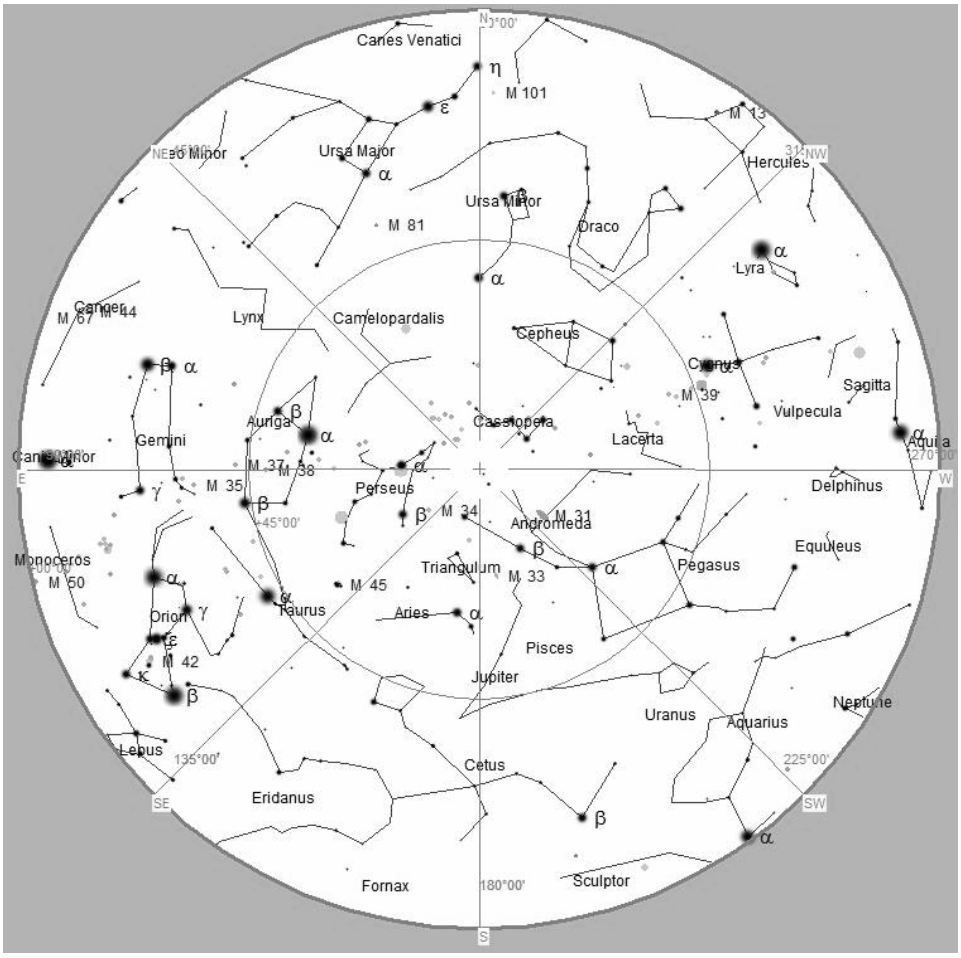
STAR CHART



The Night Sky at 10pm (GMT) next Saturday (19th Nov.)