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SciTalk

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Vast 'ocean' hidden deep inside Earth's mantle

A new study suggests that a huge expanse of water is trapped in a layer of the Earth's mantle. This hidden 'ocean' is deep inside Earth's mantle, about 700 kilometres down between the Earth's surface and the core. The hidden reservoir, apparently locked in a blue crystalline mineral called ringwoodite and the mineral wadsleyite, may hold three times as much water as all the world's oceans.

This discovery may help explain the origin of Earth's water supply, and how subterranean water affects the shifting of rock in the Earth's outer crust during plate tectonics.

Scientists have been searching for decades for evidence for a whole-Earth water cycle, which may help explain the vast amount of liquid water on the surface of our habitable planet. This hidden 'ocean' may be the evidence that Earth's water came from within.

Geophysicist Steven Jacobsen, from Northwestern University in Illinois and his colleagues used seismometers to study seismic waves from over 500 earthquakes. By studying the speed of the seismic waves at various depths in the Earth, the team saw that seismic waves seem to slow down when they hit the layer of ringwoodite in the mantle. This led them to theorise that the mineral was saturated with liquid.

This finding supports a recent study by Graham Pearson of the University of Alberta, Canada. He studied a diamond from the transition zone, between the upper and lower mantle. This diamond was carried to the surface via a volcano. It was found that it held water-bearing ringwoodite.

[Reference: Scientific American 12 March 2014, NewScientist, 21 June 2014]

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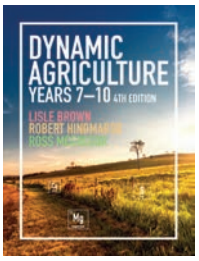

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Winners for *SciTalk 2/14*

Toni Edwards (Forbes HS), Shaina Peters (Hillston Central) and Matthew Hall (St Josephs Banora Pt) respectively won a *Past HSC Papers with Worked Solutions* book for *Biology/Chemistry/Physics (rrp $39.95 ea)*, published by Odlum & Garner.

Diary Dates

2014 International Year of Family Farming

2014

For Shell Questacon Science Circus 2014: www.questacon.edu.au/outreach/programs/science-circus

AUGUST 2014

1	Jeans for Genes Day. www.jeansforgenes.org.au/
6	Chemistry Olympiad Exam. www.asi.edu.au/olympiads/ Close date: 6/7/14. Ph: 6201 2552
11	Biology Olympiad Exam. www.asi.edu.au/olympiads/ Close date: 6/7/14. Ph: 6201 2552
13	Physics Olympiad Exam. www.asi.edu.au/olympiads/ Close date: 6/7/14. Ph: 6201 2552
15, 18, 22	Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, fax (02) 9939 6105 – come on one of these dates to celebrate National Science Week
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SEPTEMBER 2014

8, 12	Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, www.odlumgarner.com
13 (tbc)	National Schools Titration Competition (Sydney): www.nswtitration.com/
18, 19	Zombie Day (for Stage 5 students): www.diseasemuseum.unsw/edu.au
23	Spring Equinox (12:29 pm AEST)

OCTOBER 2014

12–18	Earth Science Week. www.earthsciweek.org & www.ga.gov.au/education/public-events, ph 6249 9111
13	HSC Exams commence.
17, 20, 24, 27, 31	Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, www.odlumgarner.com

NOVEMBER 2014

3, 10, 14	Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, www.odlumgarner.com
17, 21, 24, 28	Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, www.odlumgarner.com

DECEMBER 2014

2–17	Physics is Fun at Luna Park Sydney. Enquiries: ph (02) 9939 6107, www.odlumgarner.com
22	Summer Solstice (10:03 am AEDT)

JANUARY 2015 National Youth Science Forum. Forms to local Rotary club by 31/5/14, interviews from July. Only for Yr 11 in 2014. Enquiries: 6125 2777, email: nsss@anu.au, www.nysf.edu.au/

While all dates have been checked to ensure that information in DIARY DATES is correct, no responsibility will be accepted by the publisher or Editor for any omissions or inaccuracies in it.

2014 Science HSC Examination Dates

20 Oct	Biology: 9.25 am–12.30 pm
23 Oct	Senior Science: 1.55 pm–5 pm
27 Oct	Chemistry: 9.25 am–12.30 pm
30 Oct	Earth & Environmental Science: 9.25 am–12.30 pm
31 Oct	Physics: 9.25 am–12.30 pm

The saddest aspect of life is that Science gathers knowledge faster than society gathers wisdom.

… Isaac Asimov (1988)

Night Stalk 1 September–16 October 2014

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Night Stalk is easy, fun and something everyone can do. All you need is a torch and a copy of the Spotter's Log. Schools can participate by focussing on the numbers and distribution of native animals and feral pests. Choose a night or number of nights between 1 September-16 October and spotlight in your local forest/bushland. Record all of the mammals, birds, reptiles and frogs that you find, then send your Spotter's Log to Perth Zoo.

You can request a Night Stalk pack from the program coordinator. Student Activity Sheets are available online. Night Stalk has been running for over 15 years, collecting information about wild animals living near urban areas. For information: Night Stalk, PO Box 489 South Perth WA 6151. E: nightstalk@perthzoo.wa.gov.au Visit www.perthzoo.wa.gov.au/nightstalk to download a Spotter's Log.

Update on BOSTES matters

You should regularly check the BOSTES website to ensure you have the latest data – on syllabuses, past exam papers, news, Official Notices, Board Bulletins, statistics archive and more.

Review of Stage 6 Science

BOSTES has begun work on developing new NSW syllabuses for Stage 6 Science. Proposed broad directions for these syllabuses will be available for consultation from Monday 11 August. Details will be available soon on the BOSTES website.

Personalised 2014 HSC exam materials

In the 2014 HSC, Section I Part B and Section II answer booklets for Biology and Physics exams will be personalised with students' number, name and centre number. (BOSTES 17/14)

Record of School Achievement (RoSA)

Preliminary course grades (A to E) are included on each student's HSC Record of Achievement. Students who leave school before the HSC, will have their grades printed on their RoSA.

Students in Years 10, 11 and 12 can take the BOSTES' optional literacy and numeracy tests. The results enable students who leave school before the HSC to demonstrate their levels of achievement of these core skills.

Stage 5 & Preliminary course work samples to be retained

In Stage 5 Science and Stage 6 Biology, Chemistry and Physics courses, a minimum of three work samples, representing the upper, middle and lower range of achievement of the current cohort, should be retained in a format that can be uploaded electronically. Each of these work samples should demonstrate performance towards the end of the stage that is typical of the student(s) awarded a particular grade (A to E) by the school. In some cases, schools may be asked to submit work samples to ensure their grading decisions are aligned with statewide standards. More details on the BOSTES website under RoSA. (BOSTES 07/14)

BOSTES enquiries

Ph: 9367 8111, fax: 9367 8484
www.boardofstudies.nsw.edu.au
and *www.bostes.nsw.edu.au*

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- **WHAT TO DO:** Allow 1 hr for IMAX (any film), then 2–3 hours for Physics is Fun at Luna Park Sydney (rides open at 11 am, Mon/Fri + any school day in December)

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National Science Week

16–24 August 2014

This is an annual celebration of Science in Australia. Join in to enjoy and explore the wonders and benefits of Science.

There will be many Science Week happenings. For more details, go to:

www.scienceweek.net.au

Why not celebrate this year's National Science Week by going on a Science excursion? You could go to a fun park excursion through *Physics is Fun* to Luna Park Sydney on 15, 18 or 22 August 2014, or visit one of the other excursion venues on this page for National Science Week.

SHIPWRECKS, CORROSION & CONSERVATION

STAGE 6 CHEMISTRY

This program relates to the *Shipwrecks, Corrosion and Conservation* option. Students attend an AV presentation on conservation and restoration, including footage taken during the recovery of material from HMS *Bounty*. Students then participate in a hands-on workshop focusing on desalination of metal objects, metal and corrosion product identification, methods of protecting metals and rates of corrosion.

This is followed by a guided tour of shipwreck material in the museum. Students may also visit the destroyer HMAS *Vampire* and submarine HMAS *Onslow*.

Program is 4 hours, at a cost of $22.00 per student (teachers free).

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Environmental links to diseases

Children of women in contact with organophosphate pesticides during pregnancy were 54% more likely to develop autism spectrum disorders than those of women not exposed, according to a study at the University of California. Opinion is divided over the role of environmental factors. However, the results showed a very strong association in nearly 1000 families who had a child with autism or developmental disorders and who had lived near sites where four classes of pesticides had been used. Homes closest to the sites were the most affected. Scientists also plan to investigate other chemicals that could also play a role, e.g. the chemical products used in cleaning the kitchen, bathrooms and the rest of the house.

In the results of another study released in 2008, the US Geological Survey (USGS) had analysed water from nine selected rivers, which are used as a source for public water systems and found that low levels of certain synthetic chemicals remain in public water supplies after being treated in selected community water facilities. Most of the synthetic chemicals assessed in the USGS study are unregulated in drinking water and not required to be monitored or removed. Yet more than 75% of source- and treated-water samples in this study contained 5 or more chemicals. The common occurrence of chemical mixtures means that the total combined toxicity may be greater than that of any single contaminant present.

In other studies, fungicides and other pesticides have been found to be linked to the development of Parkinson's disease.

The presence of chemicals in our environment obviously needs further investigation and it would appear that action needs to be taken to limit their use.

References: (last accessed 18/7/14)
• NewScientist 28 June 2014 • www.mdpestnet.org/

Pesticide threat to biodiversity

Concern about the impact of systemic pesticides on a variety of beneficial species has been growing for the last 20 years, but the science has not been considered conclusive until now.

Systemic pesticides contain neonicotinoids and fipronil (neonics). These chemicals make up almost one-third of insecticides used. They are also commonly used in domestic treatments to prevent fleas in cats and dogs and termites in wood structures.

Neonics are a key factor in the decline of honeybees and pose a serious risk to other pollinators such as butterflies and to a wide range of other insects, microbes, lizards, earthworms, coastal shellfish and vertebrates including birds. In addition to contaminating non-target species through direct exposure (e.g. insects consuming nectar from treated plants), the chemicals are also found in varying concentrations outside intentionally-treated areas. The water solubility of neonics mean that they leach and run-off easily and have been found to contaminate much wider areas and so affect organisms in a wide range of ecosystems.

These chemicals are a nerve poison and the effects of exposure range from instant and lethal to chronic. Even long term exposure at low (non-lethal) levels can be harmful. Chronic damage can include: impaired sense of smell or memory, reduced fecundity, altered feeding behaviour and reduced food intake including reduced foraging in bees, altered tunnelling behaviour in earthworms, difficulty in flight and increased susceptibility to disease.

In 2011, the International Union for Conservation of Nature (IUCN) set up a task force to review the safety of systemic pesticides. Extensive research has shown clear evidence that these chemicals break down more slowly than early tests suggested and their effects are far more widespread than previously estimated.

The IUCN have now confirmed that present usage 'is non-sustainable' and have called for a global phase-out of systemic pesticides.

Syllabus links:

- HSC Biology 8.2 & 9.4
- HSC Senior Science 8.2 & 9.2

References: (last accessed 30/7/14)

- *NewScientist 28 June 2014*
- *www.iucn.org/*

Tumbleweeds – an introduced pest

Tumbleweeds are causing problems in the US this year, where prolonged drought and high winds have led to a huge explosion in their numbers, especially on the rolling plains of southeastern Colorado, portions of New Mexico and Texas.

These plants may grow to several metres in diameter and take a nearly spherical shape. Given their size, when tumbleweeds are blown away they can cause major problems when thousands of them come tumbling along at once, e.g. filling backyards, burying whole houses, covering streets in towns, blocking highways and irrigation canals. The weeds also pose a fire hazard because the dried-out plants are highly flammable and can ignite quickly if they come in contact with heated farm equipment.

The most common tumbleweed is not native to the US. Also known as Russian thistle, it is thought to have arrived from Eurasia in seed shipments to South Dakota in the 19th century and has spread west, according to the US Department of Agriculture

A tumbleweed is usually the above-ground anatomy of any of a number of species of plants and once this part of the plant is mature and dry, it detaches from its root or stem, and tumbles away in the wind. A tumble weed grows normally and looks green until it is mature and dry. In most species the tumbleweed is in effect the entire plant apart from the roots, but in other plants a hollow fruit or an inflorescence might act as a tumbleweed. In this case, the inflorescences break off and tumble in the wind instead of the whole plant.

Apart from its propagules (seeds or spores), the tissues of the tumbleweed structure are actually dead. Their death is functional because it is necessary for the structure to degrade gradually and fall apart so that the propagules can escape during the tumbling, or germinate after the tumbleweed has come to rest in a wet location. In the latter case, many species of tumbleweed open mechanically, releasing their seeds as they swell when they absorb water.

Figure 1 A tumbleweed along the Gila River, near Goodyear, Arizona. Photograph by Michael J Plagens.

So remember the problems caused by these tumbleweeds next time you are teaching about the effect of an introduced species into Australia and the importance of strict quarantine regulations to prevent such species coming to Australia.

References: (last accessed 30/7/14)

- *Wikipedia*
- *NewScientist 21 June 2014*
- *www.huffingtonpost.com/2014/03/27/*
- *www.arizonensis.org*

Biggest dinosaur ever has been discovered

An as yet unnamed Titanosaur species, found in the Patagonia region of Argentina in 2014, has been estimated to have been 40 m long and 20 m tall, with a weight of 80 tonnes when it walked the Earth some 95 million years ago during the Late Cretaceous period.

This truly gigantic dinosaur was a herbivore and belonged to the sauropod group of dinosaurs, which are noted for their small heads, thick, pillar-like legs, and long necks and tails.Researchers are classifying it as a new species of Titanosaur, which is a group of extremely large sauropods.

Palaeontologists were able to estimate the size and weight by measuring the diameter of load-bearing bones such as the femur and humerus. Their findings place this new dinosaur just ahead of another similar Titanosaur, Argentinosaurus, which has long been considered the largest dinosaur ever. Argentinosaurus is estimated to have weighed roughly 73 tons. It was also discovered in the same Patagonia region.

Figure 2 A palaeontologist uncovering a leg bone from one of seven massive dinosaurs found at this site in the Patagonia region.

Figure 3 One of the massive fossilised femurs used to estimate the size of the dinosaur.

Although the discovery was announced on 16 May 2014, the remains were initially discovered in 2011 by a family of rural farmers on their land. The family notified nearby Museum of Paleontology Egidio Feruglio. Researchers at the site have unearthed seven partial skeletons, consisting of approximately 150 bones. These remains have been described as in 'remarkable condition'.

References: (last accessed 18/7/14)

- *Photos from Museum of Paleontology Egidio Feruglio / José María Farfaglia*
- *www.theverge.com/*
- *Wikipedia*

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The Hessdalen phenomenon

The presence of strange balls of light (orbs) hovering above the Hessdalen valley in central Norway has been occurring for at least a century and has baffled scientists for years. Some lights drift for up to two hours, others flash white or blue and streak through the valley, disappearing in seconds, while some are large yellow lights and several lights moving in formation.

Known as the Hessdalen phenomenon, these flashing orbs can be as large as cars and can sometimes be seen in Oslo, 400 km away. Erling Strand, a computer engineer at Østfold University in Norway, has been looking for the physics behind the natural phenomenon since 1982. He set up Project Hessdalen in a bid to unite experts trying to unravel the mystery of how these orbs are formed and to stop the Hessdalen lights becoming another UFO fad.

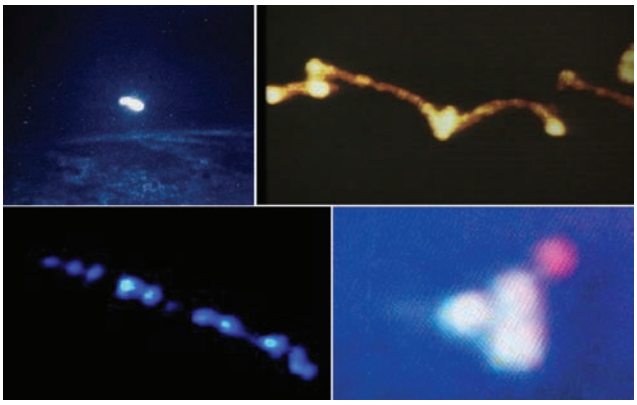

Figure 5 Strange balls of light over the Hessdalen valley

Figure 4 The Hessdalen valley in Norway

Numerous theories have attempted to explain how the orbs are created. Dr Jader Monari from Italy, has studied the Hessdalen site since 1996 and found that rocks in the valley are rich in zinc and iron on one side of the river running through it, and rich in copper on the other side. Since these metallic rocks are divided by a sulfurous river, Monari suggested that the environment formed a natural 'battery', which provides the right conditions for orbs.

Together with a colleague, Dr Monari used rock samples to create a miniature valley and dunked them in river sediment. They found that electricity flowed between the two rocks and could light a lamp. Dr Monari thinks bubbles of ionised gas are made when sulfurous fumes from the River Hesja react with humid air, forming the balls of light. The geology also forms electromagnetic field lines in the valley, which could explain why the orbs of light move around. It is thought that the energy needed to make the clouds glow could come from the charge building up.

So far, Monari's theory seems the most plausible. However, there are other competing theories – although these lack any supporting evidence yet. So the debate continues!

References: [last accessed 18/7/14]

- *NewScientist 10 May 2014*
- *sciencenordic.com*
- *www.dailymail.co.uk/sciencetech/*

Bionic pancreas shows promise for type 1 diabetes

A 'bionic pancreas' – a device using a sophisticated computer program working in concert with several diabetes management devices – successfully managed blood sugar levels in its first real-world trials on adults and children with type 1 diabetes.

With a device inserted under the skin, the digital pancreas monitored and regulated blood sugar levels by sending a signal wirelessly, every 5 minutes, to an app on a smartphone. This app then automatically calculated the amount of insulin and glucagon needed to balance blood sugar and sent a signal to pumps carried by the user to administer the required dose via a catheter.

What may be even more important is that the device took away the huge burden of constant monitoring that is required with type 1 diabetes.

Damiano, who developed this device, is a biomedical engineer. He understands the issue more keenly than most, as he is the father of a 15-year-old son with type 1 diabetes.

Type 1 diabetes is a disease that usually occurs early in life. It is an autoimmune disease caused by a mistaken attack on healthy insulin-producing cells in the body, destroying them. Insulin is a hormone necessary for controlling blood sugar levels so that sufficient glucose enters our body cells, where it is a source of energy.

People with type 1 diabetes manage their disease by careful monitoring of blood insulin levels and using injections or a tiny catheter attached to an insulin pump to deliver the insulin and glucagon needed to keep blood sugar levels within a normal range. However, figuring out exactly how much insulin to give is no easy task. Both too much insulin and too little insulin can have dangerous, even deadly, consequences.

In the current study, researchers tested the device in outpatient trials for 20 adults and 32 teenagers with type 1 diabetes. The teens were at a diabetes summer camp. Both trials included five days on the bionic pancreas and five days using their usual management with an insulin pump. The device performed well and the blood sugar levels when using the device were much better controlled than when the participants managed their usual way.

Damiano said that participants in the current study were so satisfied with the bionic pancreas during the five days that they used it that they did not want to give it up at the end of the trial.

Within 18 months, it is hoped to have the bionic pancreas device perfected, approved and available for people to use.

Syllabus links:

- HSC Biology 9.4 'Search for Better Health'
- HSC Senior Science 9.3 'Medical Technology'

References: (last accessed 18/7/14)

- *NewScientist 21 June 2014*
- *www.webmd.com/diabetes/news/*
- *www.medicalnewstoday.com/*

A pessimist sees the difficulty in every opportunity; an optimist sees the opportunity in every difficulty.

… Winston Churchill

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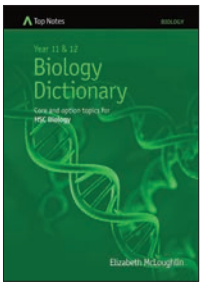

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PO Box 442, Freshwater 2096

WIN A FAMILY PASS TO IMAX

WIN

IMAX Sydney, at Darling Harbour, is open every day. More than 8 storeys high, it has the world's biggest cinema screen to give the ultimate film experience. IMAX films are entertaining and educational. They constantly change and cover a range of themes. Resource materials & teacher guides are provided.

★ ✧ ★ ✧ ★ ✧ ★

TO WIN A FAMILY PASS* TO IMAX (for 2 adults and 2 children worth $90) … send in your name, school, & school address on an envelope **by 19 September 2014** to:

IMAX Give Away, PO Box 442, Freshwater NSW 2096

* This pass will be valid for any one film for any session, except public holidays/films advertised as 'no free list'. Details at: *www.imax.com.au*

WINNER: Sarah Crawford, Lurnea HS, won an IMAX Sydney family pass for *SciTalk No. 2–2014.*

WIN A FAMILY PASS TO LUNA PARK SYDNEY

WIN

One lucky teacher's family can win this special offer through *Physics is Fun* and Luna Park Sydney.

To find out more about Fun Park Excursions for schools, go to the *Physics is Fun* website at: *www.odlumgarner.com*

* * * * *

TO WIN A FAMILY PASS TO LUNA PARK SYDNEY (unlimited ride passes for 2 adults & 2 children worth $179.80) … send in your name, school, & school address on an envelope **by 19 September 2014** to:

Physics is Fun - Luna Park Sydney Teacher Offer
PO Box 442, Freshwater NSW 2096

WINNER: Nikki Zimmerman, Kambala, won a Luna Park Sydney family pass for *SciTalk No. 2–2014.*

Astronomy

Rustle of spring

... Robert Garner

As August progresses into September and October, the nights are getting shorter, but usually clear, as humidity is low at this time of the year. So, rug up warmly, especially in August, and get out there to see what is happening in the night sky.

The Planets

Mercury is behind the Sun at present and will reappear in the evening sky towards the end of August. It will gradually climb above the horizon to reach its highest point on 22 September, when it will be near the bright star, Spica. The two are less than 1° apart on 20–21 September. From then on, Mercury will sink towards the Sun to disappear again in the twilight in October, as the planet moves between Earth and the Sun (inferior conjunction). In late October, Mercury reappears in the dawn sky, but does not appear far above the horizon.

Venus is in the dawn sky in August, but disappears in the twilight early in September as it approaches superior conjunction (where it is behind the Sun) in October. It will remain hidden behind the Sun until its return as the evening star in late November.

Mars is in the north-western evening sky in August, but gets closer to the horizon as September approaches.

Jupiter returns to the early eastern morning sky in early August and rises before dawn by September.

Saturn will be visible in the north-western evening sky from August to October. It will be close to Mars until early September. On 4 August it will be occulted by the Moon around 9:20 pm to 10:15 pm, depending on where you are. As Saturn heads to behind the Sun (conjunction) in November, it will get lower in the sky each night.

Supermoon

The Moon is in an elliptical orbit around the Earth and the Earth is in an elliptical orbit around the Sun. The Moon's orbit brings it closest to Earth at perigee (~357,000 km) and furthest from Earth at apogee (~406,000 km). According to NASA, a Full Moon at perigee appears up to 14% larger and 30% brighter than a Full Moon at its farthest point, or apogee.

There will be a 'supermoon' on 11 August – a supermoon occurs when the Full Moon and perigee in the Moon's orbit occur together on the same day. As a result, the Moon will look its biggest in size and its brightest in appearance. A supermoon occurs approximately every 14 Full Moons.

Beware the posts on Facebook, Twitter and in the press that claim a supermoon is a 'rare' event! These false claims are often accompanied by a photo of a Full Moon, but not a 'supermoon'. Wild claims are even made that a supermoon is a supernatural omen. This is a good example to illustrate that you should not believe everything you read!

Total lunar eclipse

On 8 October there will be a total lunar eclipse visible throughout Australia, although the initial stage will occur during twilight. The Moon begins moving into the Sun's shadow at 7:17 pm and finally leaves the Sun's shadow after midnight at 12:32 am. Totality will be from 9:27 pm until 10:22 pm.

Spring equinox

Earth has its spring equinox at 12:29 pm on 23 September.

Meteor showers

The brightness of the Moon is not favourable over winter this year except in early August when the Piscis Austrinids, Southern delta-Aquarids and the alpha-Capricornids can be expected to provide some good pre-dawn viewing. By October, the Orionid meteor shower will be able to be seen throughout the month with peak activity around 20 October. The New Moon at this time favours viewing this year. The Orionid shower is associated with Halley's comet.

Constellations

The winter constellations, *Sagittarius* (the archer) and *Scorpius* (the scorpion) are visible overhead each night at this time of the year. By September, they are setting a bit earlier each night and are in the western half of the sky, with *Scorpius* setting ahead of *Sagittarius*. *Scorpius* with its hook-shaped tail and bright red heart, the red star Antares, is one of the few constellations that can be easily seen to match its name. By October, less familiar constellations will be overhead.

In the south-west, α-Centauri and β-Centauri, the two brightest stars in the constellation *Centaurus*, are pointing to *Crux*, the Southern Cross, which will appear tipped a bit onto its side. α-Centauri is the brighter of the two pointers and further from *Crux*, while β-Centauri is somewhat less bright and closer to *Crux*. The constellation *Centaurus* actually surrounds *Crux* on three sides. α-Centauri is the third brightest star seen in the night sky from Earth, with only the stars Sirius and Canopus being brighter.

It is worth noting that α-Centauri is actually a triple star system. At 4.37 light years away, these three stars are the closest stars to Earth after the Sun. The two brighter of these stars are easily seen as separate stars using binoculars, but the third star of the system is much fainter and impossible to see with only binoculars or small telescopes. α-Centauri is thought to have a planet in orbit around one of its stars. This planet, being outside our Solar System, is called an exo-planet. It is the closest exo-planet to Earth, out of the 900^{+} exo-planets so far confirmed to exist.

In *Crux* itself, the coal-sack nebula can be seen on moonless nights as a dark region between α-Crux and β-Crux, the two brightest stars of *Crux*. Just above *Crux*, is the largest and brightest globular cluster in the sky, ω-Centauri. The ω-Centauri cluster contains approximately 1,000,000 stars and appears as just a fuzzy patch to the naked eye in very dark skies, but is a good object to view with binoculars or a small telescope as this will show that it consists of a huge number of stars.

Using a Sky Chart / Planisphere

Remember, viewing the night skies is much simpler if you have a Sky Chart or Planisphere. See Box 1 about easily obtaining one of these.

Box 1: Sky Charts & Planispheres

- You can download free sky charts each month to explore the night sky from: *www.skymaps.com/downloads.html* Make sure that you scroll down to 'Southern Hemisphere Edition'.
- A planisphere (star wheel) helps to find stars and locate constellations. These are inexpensive and available from astronomy shops, or you can download one – make sure it is for the Southern Hemisphere. While the site itself is out-of-date, there is a planisphere (star wheel) to print and use at: *http://members.ozemail.com.au/~starrylady/resources.html*

MACQUARIE UNI OBSERVATORY & PLANETARIUM PUBLIC FRIDAY NIGHT OBSERVING

The Macquarie University Observatory (access via Gymnasium Rd) is open to the public every Friday night (March–Dec inclusive). It opens 8–9.30 pm (in AEDT) or 7–8.30 pm (in non-AEDT).

Bookings are essential and must be made online at: *physics.mq.edu.au/community/observatory/* If doubtful weather, check online after 5 pm.

There are also two **planetarium sessions** per semester on Friday nights from 6–7 pm, in the E7B Courtyard at Macquarie Uni. Tickets must be booked online at: *physics.mq.edu.au/community/planetarium/#sessions*

Solar farm uses molten salt to store heat for use in generating electricity

A renewable and sustainable way of generating electricity has been set up about 110 kilometres south-west of Phoenix, Arizona by Abengoa Solar. This is Solana, the largest solar plant of its kind in the world. It is directly coupled to the biggest non-hydroelectric energy-storage system in the US. Completed in October 2013, it is a zero-carbon power plant that could underpin the energy grid of the future.

Solana uses molten salt thermal energy storage. It has a total capacity of 280 megawatts, which is enough to power 70,000 homes, while avoiding 475,000 tons of carbon dioxide per annum compared to a natural gas plant. Its name is the Spanish term for 'sunny spot'.

Figure 6 Aerial view of the power block at Solana Solar Generating Station, surrounded by its mirrors.

It pumps synthetic oil out through thick pipes, from which the oil is channelled into thinner piping that runs right through the focal points of the 2700 parabolic trough mirrors. These mirrors follow the Sun to focus heat on the pipes that are laid out over 780 hectares. The oil absorbs the heat of the Sun until it reaches nearly 400°C. It then returns to the plant, where the oil superheats water vapour that spins two 140-megawatt turbines to produce electricity.

The Solana Generating Station is designed to provide six hours of energy storage. Large white tanks, filled with molten salt, store enough heat to keep the turbines spinning at full capacity for up to 6 hours after sunset or if cloudy. The oil that has been heated in the field of large mirrors unloads its heat into the salt when the generators are at capacity. These tanks are what make this concentrating solar power (CSP) technology very useful, as it means that power can be generated whenever the grid operator needs it to meet demand requirements. This allows the plant to generate about 38% of its rated capacity over the course of a year. This is an advantage over photovoltaic systems, which can only be used in the daytime.

Figure 7 Thermal storage tank and some of the parabolic trough mirrors.

Heat can be stored far more efficiently than electricity, as it does not need to be converted to other forms.

At present, Solana is one of a few such solar power plants. A number of other solar power stations are either under construction or just recently completed, e.g. Ivanpah Solar Power Facility (California, 392 MW), Solaben Solar Power Station (Spain, 200 MW), and the Andasol solar power station (Spain, 150 MW). There are plans to build many other large solar thermal plants in the next year or so. Some existing coal-fired or oil-fired power plants are looking at adding on solar units, e.g. Liddell Power Station (NSW) and Kogan Creek (Queensland).

References: (last accessed 18/7/14)

- *www.abengoasolar.com – photographs from here*
- *www.csp-alliance.org/*
- *Wikipedia*
- *NewScientist 19 April 2014*

Spider silk will save Private Ryan's 'privates'

Spider silk is widely considered a superfibre with potential medical and military applications. However, cost effective production of spider silk is pretty costly when you get it the regular way – you know, from a spider.

But scientists at the US-based Kraig Biocraft Laboratories in Michigan have just announced in July that they have discovered how to get spider silk from the silkworm moth and so can double the production rate of their commercial product, Monster Silk.

Kraig's scientists managed to get the silkworm moths to produce spider silk by inserting specific genes from spiders into the silkworm's chromosomes. The silkworm moths then produce a fibre that is identical to spider silk. The silk's flexibility and strength can be adjusted by simply shifting the DNA sequence around.

Spider silk is stronger and lighter than most other fabrics, so it can be used in things like body armour, medical sutures and even underwear. The US military is experimenting with silk underwear to protect soldiers'… privates … from explosions, since silk does not melt onto skin when exposed to extreme heat. It also resists penetration by finer particles like sand and dirt, which can keep wounds clean.

Kraig's current production run is largely headed to Warwick Mills, a speciality textile manufacturer that focuses on protective applications like body armour and fireproof wearables. They are making the first Monster Silk textiles, and their research will lay the groundwork for the first commercial sales as soon as next year.

Figure 8 Monster silk moths were engineered with red eyes so scientists can tell them apart from conventional moths.

Medical and military applications are where the money is, along with the opportunity to save lives. But those markets will take years to reach fruition thanks to lengthy approval processes by authorities. In the shorter term, Kraig will look at the traditional silk clothing market, which is worth as much as $5 billion per year. No doubt spider silk will see increased usage in textile blends in the near future.

References: (last accessed 18/7/14)

- *www.wired.com*
- *www.sciencealert.com.au*
- *Photograph from Kraig Biocraft*

COMPETITION CORNER

WIN: *Insight Science Yr 7 & 9 Student Books, Workbooks, obooks/assess + Teacher obooks/assess*

INSIGHT SCIENCE *Australian Curriculum for NSW*

Oxford's *Insight Science* series by Jenny Zhang *et al* comprehensively cover each syllabus progression point to deliver all student outcomes for the NSW Syllabus for the Australian Curriculum for Years 7, 8, 9 and 10. The carefully structured learning design and engaging presentation of the student text, workbook and obook/assess plus the teacher obook/assess will help you optimise student understanding, personalise teaching and learning and deliver better results. Great value packs for Stage 4 and Stage 5 are available with several options. Sample pages are online, plus free trials of the obook/assess. For more details: *oup.com.au/secondary/australian_curriculum_NSW/Insight_Science*

HOW TO ENTER: Send an answer to the Quiz Question, your name, school and school address on an envelope to: Competition Corner, PO Box 442 Freshwater 2096 – by 19 September 2014.

QUIZ QUESTION: Was the world's largest dinosaur so far discovered a herbivore or carnivore?

SciTalk 2/14 **winner:** *iScience Year 10 Text* book published by Nelson, was won by Jenny Perry, Ambarvale HS.

SciTalk 2/14 answer: nucleus, mitochondria and chloroplasts

SUBSCRIPTIONS … *SciTalk* is available FREE to all secondary science faculties in NSW and the ACT. It is also published on our website. If you would like to receive your OWN personal copy of *SciTalk*, subscriptions are available for $20/4 issues or FREE if emailed to you. Please send either your email address or a cheque for $20 + GST = $22.00 (to *SciTalk*), plus your name, address & ph no … to receive the next four issues of *SciTalk*.

SciTalk

SciTalk is a quarterly newsletter for secondary Science educators. Now in its 20th year, it has been produced by Odlum & Garner as a service to Science teachers since 1995. It is sent FREE-of-charge to all secondary Science faculties in schools and TAFEs throughout NSW and the ACT.

SciTalk aims to provide science teachers with up-to-date information, important dates, the latest products available, plus 'what's on' in various excursion venues, and more.

Please pass *SciTalk* on to all Science teachers at your school so they can benefit from it – or put it up on your notice board for reference.

Contributions, advertising and inserts are welcome.

Copies of *SciTalk* are also available at:

www.odlumgarner.com

CONTRIBUTIONS

SciTalk is due into schools mid-term. All contributions for *SciTalk* should be directed to the Editor (contact details are below).

CLOSING DATES

- *SciTalk* No. 1–January 2014 … Dec 19
- *SciTalk* No. 2–May 2014 … April 11
- *SciTalk* No. 3–August 2014 … June 27
- *SciTalk* No. 4–October 2014 … Sept 19

ADVERTISING & INSERTS

All enquiries to the *SciTalk* Editor:

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