

Summer 2017 Number 16

Kielder Observatory Newsletter



Observatory to
appear on BBC's
'Wild UK'

NEWS

Fancy a PhD?

SCIENCE

Life through time and
space

OBSERVING

Highlights
Aug/Sept/Oct

THE SUN

We take a look at our
nearest star



EDITORIAL

Welcome to the summer edition of the KOAS newsletter. In this edition we, appropriately, take a look at our nearest star, the Sun, whilst long-time Kielder supporter (and ex-secretary) Wallace Arthur tells us about his new book exploring connections between biology and astronomy.

Nigel Metcalfe

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Kielder Observatory Astronomical Society

Registered Charity No: 1153570.

Patron: Sir Arnold Wolfendale 14th Astronomer Royal

Kielder Observatory Astronomical Society is a Charitable Incorporated Organisation.

Its aims are to

- * Promote interest in the science of astronomy to the general public
- * Facilitate education of members of the public in the science of astronomy
- * Maintain an astronomical observatory in Kielder Forest to support the above aims

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DIRECTOR'S CUT

Hello all, well the first thing to mention is of course that we are on the right side of the solstice!



So, this means that the skies are getting darker, albeit very slowly, by the end of July it is noticeable again with darkness returning to the skies above the observatory.

Welcoming back the dark skies is always the highlight of the team's year as it signals the return of what we all love to do more than anything else...stargaze! The start to the season for me begins with the Perseid meteor shower, this year it peaks on the night of the 11th August and into the wee small hours of the 12th. With a moon rising at 11pm it will hamper observations of the fainter meteors however I'm still hopeful of great observations and a good meteor count.

Lets hope for clear skies! We are running 4 events for the meteor shower and all are sold out!

The summer is always a testing time for the observatory staff having to deal with the lighter skies, the reward being, Autumn is near and with it arrives the summer Milky Way and its retinue of objects to observe. It is also a testing time for the admin staff who with me head up operations at the facility. We all keep a keen eye on performance and bookings of course and look to trends that give us information on how to organise and strategically plan our operations. Historically we have always had a little slump during the summer that would coincide with the summer lighter nights...this year it didn't come at all and we think its due to the popularity of our observatory reaching epic proportions. This means that organizationally we can plan to expand our operational narrative and so reach more people with the Kielder message to enthuse educate and inspire.

So as we all head into another season of observing and learning about our universe, I say thank you for supporting us and keep looking up.

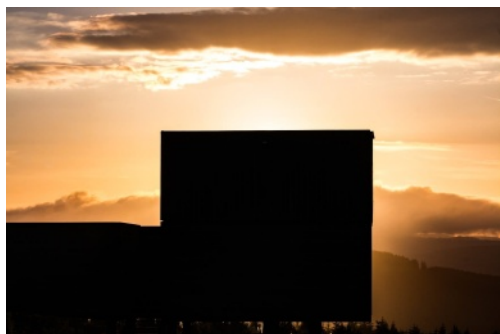
Gary Fildes (FRAS MSc Hon.Caus.)



KOAS NEWS

TRUSTEE NOTES

The trustees have met twice since the last newsletter, once at the end of April, then again at the end of May. In between the two, another trustee, Anna Charlton, joined, taking the total to eight. The constitution allows for twelve, so there is a little way to go yet!



Anna was born in the Brecon Beacons National Park, and has always been fascinated by Science and the Countryside, a childhood full of camping under Dark Skies. She attended Imperial College where she completed an undergraduate degree in Chemistry followed by a PhD in Semiconductor Physics. After a stint working in Japan's NTT Laboratories, she began a career in Management Consultancy and worked for over ten years at Accenture specialising in Customer Experience Design, Marketing and Business Change Management.

Having met William, Anna escaped London and moved to rural Northumberland where she now works alongside William managing the Hesleyside Estate, modernising and sharing 900 years of North Tyne History. She is a trustee of the Calvert Trust Kielder, enjoys a number of voluntary positions and specialises in rural diversification and development.

There is nothing new to report on the Forestry Commission lease. Matters are mostly agreed and the trustees are just waiting for the legal documents.

At the May meeting the trustees agreed to fund the appointment of a new science presenter, partly in anticipation of the increased workload the new observatory building would bring.

Ticket sales have held up well this year, even in to the summer period, which in previous years had shown a slow-down.

The trustees will next meet in mid-July.

* * * *



OBSERVATORY NEWS



Guests are shown the wonders of the night sky.

Planning for the new building is well underway, and hopefully a start will be made on the construction in the next month or so.

The new science presenter post mentioned in the Trustee Notes has been filled and Adam Shore will join us from August 14th - more on this in the next newsletter.

Make a note in you diary for July 25th - filming took place at the observatory last

week for the BBC's new 'Wild UK' series, and we expect the episode to be broadcast on BBC1 on that date. We also had a German film crew here at the end of April, and Gary gave an interview to BBC Radio Scotland.

In May, Gary went down to the Eden Project in Cornwall to give a presentation and to discuss possible future collaborations. He will be returning there twice in August. He and trustee Tom Grieveson have also had a meeting with



OBSERVATORY NEWS

the Educational Steering Group from Tees Valley, in order to further our plans for STEM activities involving local schools.

We have also had a visit from Tony Gates, CEO of Northumberland National Park Authority and his colleagues from Exmoor, and a representative from the Hungarian Astronomical Society!

At the end of May, the Observatory had a presence at the Northumberland County Show at Bywell Hall near Stocksfield, along with our partners from Kielder Water & Forest Park, and last month we had representatives at the official opening and launch of latest phase of development at Kielder Waterside.



Space Kids!

The ever popular Space Kids will be running from 4pm to 6pm most Tuesdays

& Thursdays throughout the Summer school holidays. So book your place now! We also have a Dilston Stargazing event on the evening of August 4th.

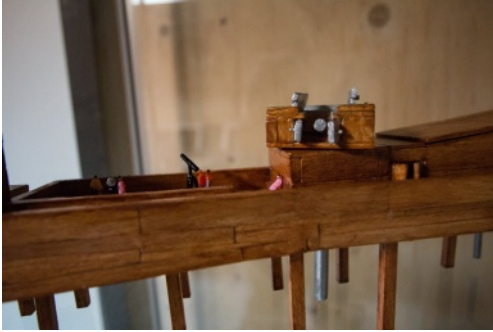


Who needs a telescope? Our guests gaze at the Milky Way through the dome opening.

On a more academic note, we are now collaborating with the Faculty of Arts and Creative Industries at Sunderland University to offer a National Productivity Investment Fund PhD entitled "Visualising astrophotography: science and creativity – Kielder Observatory". Hopefully this exciting new venture will be a productive exercise for both parties, with one aim of the research being to provide KOAS "with new visual representations that help tell the story of the facility and the imaginary power of 'dark skies.'"



OBSERVATORY NEWS



This wooden model of the observatory was presented to the team at the observatory by our wonderful guest, Alan Crisp. Alan has attended the observatory multiple times and in between his last visits he has been hard at work building a model of the observatory. We love it! Thank you very much Alan for your generous gift.



"All the team were very welcoming, friendly, helpful and very knowledgeable about their chosen field.

It fulfilled all expectations, and we were exceptionally lucky with the weather and viewing the ISS that just happened to shoot past, what a bonus! My son's class & teacher enjoyed viewing the pictures your members of staff & he took, he was really chuffed. Thanks all for a wonderful experience."

John Sam & Nathan - Rugby



OBSERVATORY NEWS



Last but not least, we have also been sent this lovely drawing by Daisy!

"Absolutely loved it. The staff were very passionate and giving us lots of information about what we were looking for. They all had different specialities which was great. We were lucky with the weather and got to see Jupiter/Saturn/Star Clusters etc. They were even able to point out the ISS as it flew by!
Just amazing for anyone who loves space and is fascinated by the night sky.
Thanks very much Kielder staff."

Chloe



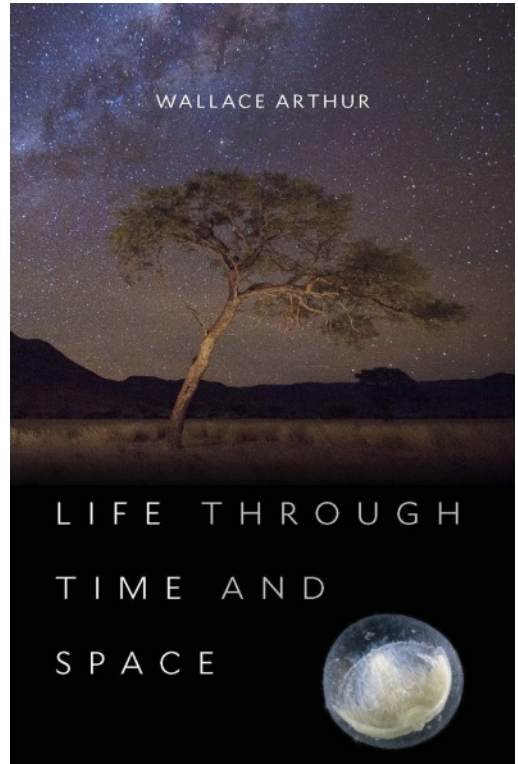
SCIENCE SLOT

Evolutionary biologist Wallace Arthur mixes astronomy with biology as he tells us about his new book, which explores the possibility of life evolving on exoplanets

I started volunteering at the observatory in 2012 and became a Visiting Scientist there in 2016. Now I have a 'popular science' book about to be published, entitled *Life through Time and Space*, and I thought I should explain to all my fellow volunteers, as well as to staff and KOAS supporters, what this strange mixture of a book is all about. So, here goes...

I'm an evolutionary biologist; I've been publishing scientific papers in this area for donkey's years. I'm fascinated by how life-forms have evolved on our planet over most of its history – about 90% of its history, to be as precise as we can be about such things. But in recent years, and in particular since my association with the observatory began, I have also become fascinated by the possibility that life-forms have evolved on exoplanets – perhaps on lots of them.

So, I've now been thinking for some time about this issue of the evolution of life elsewhere than on Earth – while



The main photo on the front cover of the book shows part of the Milky Way as seen from the southern hemisphere (Namibia). In the foreground is a camel-thorn tree. Inset at the bottom right is the embryo of a horseshoe crab. This embryo encapsulates both timescales: evolutionary time because these amazing animals are examples of 'living fossils', having changed little over hundreds of millions of years; and developmental time because we see here a frozen moment in the trajectory from microscopic fertilized egg to foot-long adult.



SCIENCE SLOT

stargazing at the observatory, sitting at my computer, or relaxing in the bath. And this book is the result. It's a journey through time and space that takes the following form.

The journey begins in the Andromeda galaxy, or M31 in crazy comet-hunter lingo. Gaze up at this fuzzy blob either with the naked eye or through binoculars, or better still through a telescope at the observatory. It seems almost certain that there is someone looking back at you, because the number of habitable planets in M31 is probably well into the billions. We can't yet see these planets, because they're so distant, but we have no reason to believe that Andromeda is any different from our Milky Way home in the fraction of its stars that have planets (about 90%) or the fraction of those planets that are potential homes for life (harder to estimate but perhaps about 5%).

However, there's a problem for any mega-intelligent Andromedan life-forms who were looking towards us last night with telescopes that we can only dream of – ones that can see not just planets but individual creatures walking across their landscapes. They wouldn't see us, but rather our distant ancestors, perhaps of

the species *Homo habilis* – or 'handy man' – because light from here takes 2.5 million years to reach them, just as Andromedan light takes 2.5 million years to reach us.

Each of these ancient 'handy people' had a brain a bit less than half the size of ours – closer to that of a Fiat 500 than our own 1.4 VW Golf (well, minus about 50 cc). We're smarter than they were, and in large part this is due to our significantly bigger brain.

But wait a moment. No species of animal on Earth can be characterized by a brain of a specific size. Each generation of even the brainiest animals – ourselves and the great apes – starts off life in the form of tiny embryos with no brains at all. An early human embryo doesn't even have any nerve cells, let alone a miniature brain. Where does a brain come from? Somehow, the cells of an early embryo – of some kinds of animals but not others – know how to divide and to enable some of the resultant daughter cells to adopt a nervous fate; and some great-granddaughter cells later go on to become the brain.

So, the book's journey is threefold:



SCIENCE SLOT



At one level, this is simply a photo of the author. At another level it is something else entirely. It is a photo of an animal and a plant, and it highlights the early separation of these two kingdoms in the history of life on Earth. But is such separation necessary? Might not evolution on exoplanets produce hybrid creatures such as John Wyndham's famous *triffids*?

it's a journey in interstellar and intergalactic space; it's also a journey through evolutionary time; and in addition it's a journey through the much shorter, but equally important timescale of embryonic development.

The immensity of intergalactic space is hard for us to comprehend. Our Milky Way home, vast as it is, makes up only a

tiny fraction of our local galaxy supercluster of Laniakea ('spacious heavens' in Hawaiian). This is shown here as a twig-like structure with a cosmic butterfly perched on it. But for the purpose of searching for life, we are best off looking much closer to home. In fact, we should concentrate not just on the Milky Way galaxy, but on our own local corner of it – the Orion arm.

There are countless exoplanets in the Orion arm. A natural question for us to ask is: How close to us is the nearest exoplanet on which life-forms exist? And what is the nature of those life-forms and their own journeys through evolutionary and embryonic time? Clearly we can't give definite answers to these questions yet, but maybe we're getting close to being able to do so – especially given the accelerating advances in exoplanet science that we're currently witnessing.

Since we're getting close, speculation can be thought of as soon-to-be-testable hypotheses. So let's speculate a bit. Here are some hypothetical answers to the above questions: Life exists on exoplanets within a few tens of light years from Earth. We'll perhaps get indirect evidence of its existence in the form of a



SCIENCE SLOT

breathable atmospheric composition within the next few years. Adult alien life-forms will be the product of evolution and embryonic development not too different from their equivalents here.

Perhaps that all sounds a bit far-fetched to a non-biologist. But it's not. The criteria for Darwinian evolution to take place – reproduction, variation and inheritance – are likely to be widespread characteristics of life, wherever it is found. And the likelihood of adult alien life-forms springing into existence from eggs, without a series of preceding developmental stages, is low.

This line of argument can be summed up in the following form: Biology is a multi-planet science. Life-forms beyond our Solar System are more likely to be similar to terrestrial life than different from it in their essentials – carbon-based metabolism, cellular construction, Darwinian evolution. The details of course will differ, and only time will tell how big or small those differences actually are.

Will the first life-forms we discover rival humans in intelligence? Almost certainly not. If Earth's history is anything to go by, most life-bearing planets will be



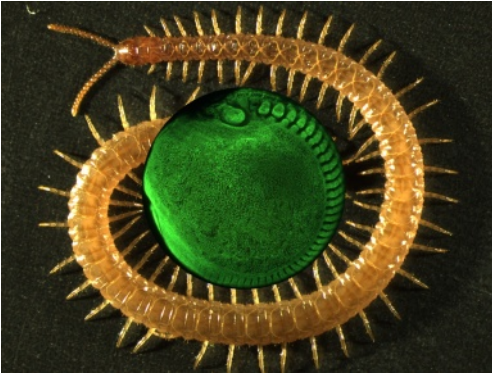
An imaginary cosmic butterfly shown resting on a twig that is in the shape of Laniakea, our home galaxy supercluster. The Milky Way is located towards the end of the most pronounced rightward-pointing twiglet. An interesting philosophical question: do cosmological structures like galaxies have a function, in the same way that biological structures such as butterfly wings have a function?

Illustration by Stephen Arthur.

characterized by non-intelligent life for most of their history; but intelligent life will not arise until very late in the day.



SCIENCE SLOT



You can find further details of the book either at the Harvard site

<http://www.hup.harvard.edu/catalog.php?isbn=9780674975866>

or at Amazon.uk

<https://www.amazon.co.uk/Life-through-Space-Wallace-Arthur/dp/0674975863>

Wallace Arthur is Emeritus Professor of Zoology at the National University of Ireland, Galway, and a Visiting Scientist at Kielder Observatory

Are there extra-terrestrial centipedes? The likelihood of finding these is probably higher than of finding extra-terrestrial humanoids. Centipedes have been around on our planet for more than 300 million years, Homo sapiens for less than 1 million. And there are about 4000 species of them today, in contrast to the single species of human. The round green object in the centre that looks a bit like a stripy asteroid is in fact a centipede embryo.

Photo courtesy of Carlo Brena.

We may discover simple life quite soon; discovering ET will take a little longer.

Not been to Kielder Observatory yet?

Then why not book one of our events for you or your family?

Advanced booking is essential. Weekend events can fill up several weeks in advance. Please book online at <http://www.kielderobservatory.org/events/> or call us on 0191 265 5510. We can also be contacted at admin@kielderobservatory.org



NIGHT SKY

AUGUST 2017 (times in BST)

Lunar phases

Full moon	07/08/2017	19:10
Last quarter	15/08/2017	02:14
New moon	21/08/2017	19:30
First quarter	29/08/2017	09:13

PLANET SUMMARY

Venus will be lost in the morning twilight. Mars is in conjunction with the Sun this month. Jupiter will be visible low in the west in the evening twilight. Saturn will be high in the sky once the sky gets reasonably dark [after 2230]. Uranus is visible for most of the hours of darkness [2230 to 0345].

THE STARS AT 11PM (BST)

North – Perseus, Andromeda and Cassiopeia are nicely placed for viewing all night

East – Pegasus and Cygnus are well placed for viewing

South – Lyra is high up with Sagitta the Arrow just below. Hercules and Ophiuchus are well placed with Sagittarius and Scorpio on the southern

horizon

West – Bootes is nicely placed with Virgo near the horizon

METEOR SHOWERS

The major focus for August is the Perseid Meteor Shower of the 12th and 13th August. This shower is a regular performer with around 70 shooting stars per hour. The meteor particles are the leftovers from Comet Swift-Tuttle. This Comet has a 133 year orbit that is very eccentric taking it far away from the Sun for at least 75% of the Comet's orbit. The Comet is currently heading away from the Sun and is presently located in the outer reaches of the Solar System. For 2017, with a last quarter Moon it will be a challenge to see this shower because the Moon will be already in the sky as the constellation of Perseus rises at around 11pm BST. More details can be found here... <http://earthsky.org/?p=165416>. Also this month is the Delta Aquarid meteor shower. Active at around the same time as the Perseids, Aquarius rises just before midnight and the Moon is right in

The Planets 15/08/2017

	Sun	Mercury	Venus	Moon	Mars	Jupiter	Saturn	Uranus
Rise	05:47	07:55	02:31	23:29	05:07	11:15	17:00	22:15
Transit	13:12	14:15	10:45	07:09	12:49	16:43	20:52	05:19
Set	20:35	20:36	18:59	14:49	20:30	22:11	00:48	12:19



NIGHT SKY

SEPTEMBER 2017 (times in BST)

Lunar phases

Full moon	06/09/2017	08:02
Last quarter	13/09/2017	07:24
New moon	20/09/2017	06:29
First quarter	28/09/2017	03:53

PLANET SUMMARY

Mercury will be visible in the morning twilight but it will be a difficult object to locate with the bright Sun only about 30 degrees away. Venus will be quite close to Mercury but as it is brighter it should be easier to locate. Mars is very close to Mercury so will again be a challenge to locate. Jupiter is lost in the evening twilight but may be located in daylight – but necessary precautions need to be taken not to point the telescope at the Sun during a 'goto' to Jupiter. Saturn is visible in the evening twilight. Uranus will be visible for most of the hours of darkness.

THE STARS AT 10PM (BST)

North – Cepheus – the King – is almost overhead – and upside down. Cassiopeia,

Bootes and Perseus are nicely placed. Auriga is near the horizon.

East – Pegasus and Andromeda are nicely placed. Pisces and Aries are low down. Taurus is just starting to rise.

South – Ophiuchus is low down with Aquila nicely placed. Delphinus and Sagitta are nicely placed with Cygnus and Lyra almost overhead.

West – Lyra, Hercules and Corona Borealis are nicely placed, with Serpens, Bootes and Coma Berenices low down.

METEOR SHOWERS

The only active shower in September is the Southern Taurids. However as the name suggests these are not seen in the northern hemisphere at this time of year.

COMETS

There are no bright Comets in the sky this month.

NOCTILUCENT CLOUDS

These should still be active well into September.

The Planets 15/09/2017

	Sun	Mercury	Venus	Moon	Mars	Jupiter	Saturn	Uranus
Rise	06:41	04:56	03:52	00:43	05:03	09:46	15:00	20:12
Transit	13:02	11:59	11:17	08:54	12:03	15:02	18:51	03:14
Set	19:23	19:01	18:40	17:00	19:03	20:18	22:43	10:13



NIGHT SKY

September night sky.



Prominent in September, in the constellation of Hercules, is Messier 13. It is a Globular Cluster of 300,000 stars lying at a distance of 25,000 light years



NIGHT SKY

OCTOBER 2017 (times in BST)

Lunar phases

Full moon	05/10/2017	19:40
Last quarter	12/10/2017	13:25
New moon	19/10/2017	20:11
First quarter	27/10/2017	23:22

PLANET SUMMARY

Mercury is too close to the Sun this month. Venus is a morning object visible in twilight. Mars is too close to the Sun. Jupiter is also in solar conjunction this month. Saturn will be just visible in the evening twilight. Uranus is close to opposition and hence will be visible during the hours of darkness this month [approx 10pm to 0530].

THE STARS AT 10PM (BST)

North – Cepheus is prominent – looks like an upside down house. Draco and the two Bears are nicely placed for viewing. Auriga is low down in the north-east. East – Cassiopeia and Andromeda are nicely placed for viewing as is Perseus. October is a good month to searching for

Messier 31 in Andromeda and the Double Cluster in Perseus.

South – Cygnus is high overhead.

Delphinus and Sagitta are nicely placed.

Capricornus and Sagittarius are low down.

West – Cygnus and Lyra are high up, with Hercules [the 'Keystone'] and Corona Borealis nicely placed. Ophiuchus and Bootes are low down. Looking at Lyra - just below Vega its brightest star- is a lozenge shaped group of four stars. About half way between the two lower pair of stars is Messier 57 – which looks like a 'smoke ring' in a medium sized telescope.

METEOR SHOWERS

The active showers visible in October are the Draconids – around 9th October and the Orionids – around 20th October. The Draconids are few in number – about 5-10 per hour – but they are visible for most of the night being circumpolar. However the Moon will be in the sky for most of the night so viewing this shower will be difficult.

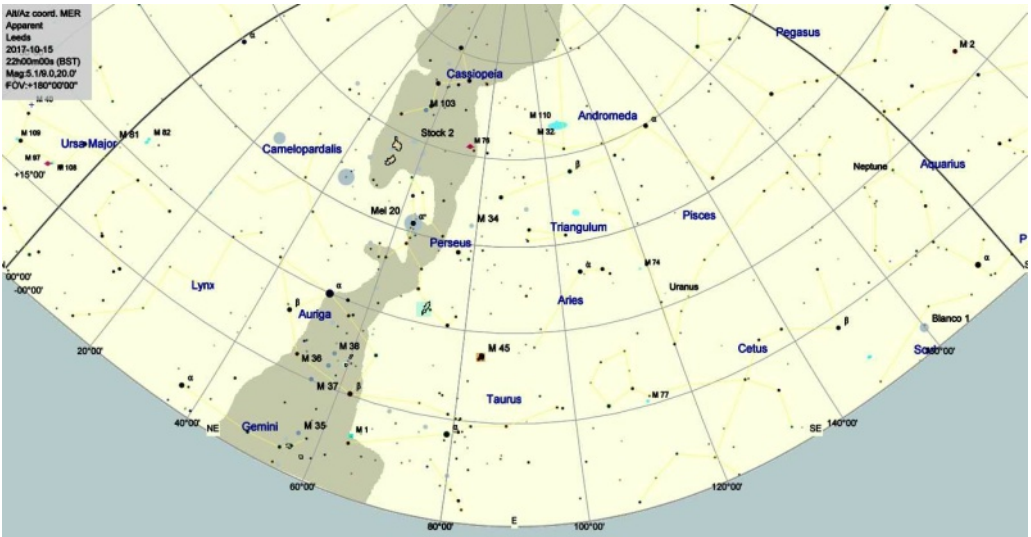
The Planets 15/10/2017

	Sun	Mercury	Venus	Moon	Mars	Jupiter	Saturn	Uranus
Rise	07:34	08:01	05:28	02:03	04:56	08:24	13:10	18:12
Transit	12:53	13:11	11:38	09:34	11:15	13:27	17:00	01:12
Set	18:11	18:19	17:46	16:51	17:34	18:31	20:51	08:09



NIGHT SKY

October night sky.



The Orionids are a regular performer. Associated with Comet Halley, they are quite frequent – about 20 per hour, quite bright and often quite colourful. With a New Moon on the 19th 2017, it could be an excellent year to observe this shower.

COMETS

There are no bright Comets in the sky this month.

Night Sky credits: Lunar and planetary data sourced from Cybersky 5



Messier 31, the great spiral in Andromeda, is high up in October. It is a galaxy like our own Milky Way and is actually moving towards us. One day in the very distant future we may collide!



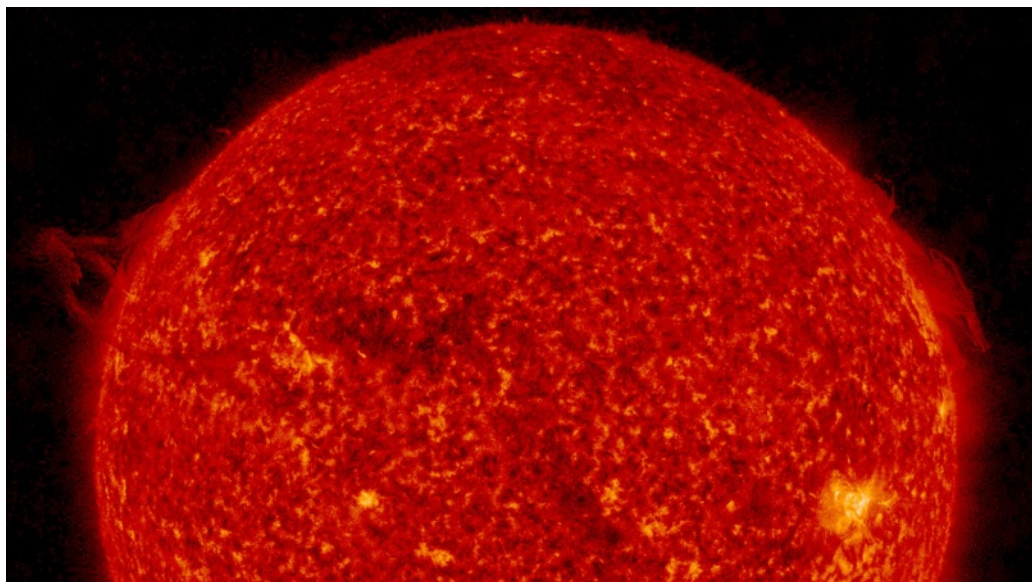
ASTRONOMERS' TALES

Volunteer Finn Burridge tells us a bit about our nearest star ...

The Sun: A giant Cosmic Radiator

Summertime is a brilliant opportunity to get outside- in warmer weather- and do astronomy. This year, as it would seem,

offering some exceptional weather, wonderfully warm evenings and some questionable British tan lines. This immense ball of superheated plasma sits 150 Million km away from Earth and without it, life on this planet would be impossible. It gives us the perfect temperature for liquid water, light during the day, and feeds every plant on the



An extreme ultra-violet image of Solar prominence activity in December 2016, taken by the Solar Dynamics Observatory.

Credit: NASA/GSFC/Solar Dynamics Observatory

we've been especially lucky as one of the rarest celestial bodies to grace the UK summer skies is making an unusually long appearance! Yes folks, that's right, the Sun has actually been out this summer,

planet. But just how does the Sun work? What makes the Sun so hot and so bright, and just how much energy does the Sun emit?



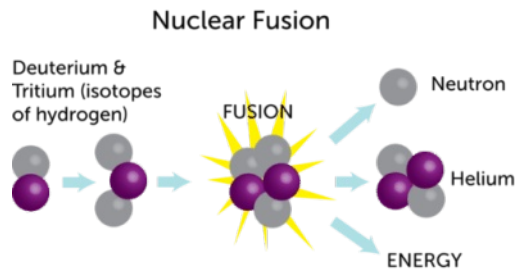
ASTRONOMERS' TALES

Firstly, it's worth noting that the Sun is very very very powerful! Even from 150 Million km away, it only takes around 10-15 minutes, in some places, to burn your skin, and its rays are even powerful enough to melt coins if magnified correctly!* So remember, you should never look at the Sun directly as it can cause serious damage to your eyes! Imagine sitting 150 Million km away from your radiator at home and feeling your skin burn. It may seem strange to refer to the Sun as a radiator but in actual fact, that's exactly what the Sun is. The Sun transfers all of its energy in the form of electromagnetic radiation, light for short, from all areas of the spectrum. Amazingly, the Sun emits more green light than any other colour, but not by much, so to our eyes it appears white. This light is what heats up the Earth's surface and atmosphere, and the amount of energy transferred to the Earth every second is astonishing, around 180000000000000000 Joules per second! Even if we were able to harness just 10% of only 0.1% of around 60% of this total energy (that's just 0.0006% of the Sun's energy at Earth), we could supply every single country with the entirety of its electrical energy. 4 times. Even just a 1 metre patch of sunlight provides enough

energy to power around 2-3 desktop pc's! And don't forget, all this power is coming from a source 150 Million km away! The total output power of the Sun itself is genuinely astronomical, pardon the pun, at around 3.8×10^{26} Joules per second (that's 38 with 25 zeroes!!).

To put that in perspective, the recommended energy intake for an adult man, per day, is around 9720 kilo-joules. Meaning the Sun alone could power 39 Quintillion men per second! That's nearly 5.4 billion Earths worth of men! Phew, that was a lot of numbers, I mean, A LOT of numbers, so it begs the question, if the Sun is this powerful, where does all this energy come from!

The answer is a process known as nuclear fusion. To understand the process, firstly we must understand what the Sun is, and a bit about its history.

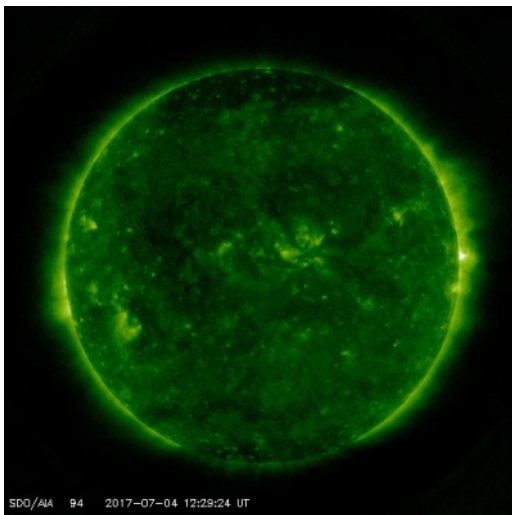


Source: <https://www.ck12.org/book/CK-12-Physical-Science-Concepts-For-Middle-School/section/3.66/>



ASTRONOMERS' TALES

The Sun, essentially, is a huge ball of hydrogen gas that formed around 4.5 billion years ago when a cloud of gas and dust, called a nebula, collapsed under its own gravity. Naturally, the nuclei of the hydrogen atoms inside the Sun are repelled from each other because they have the same positive charges! In the same way it takes a lot of energy to push two magnetic “Norths” or two magnetic “Souths” together, it takes a lot of energy



The Sun as seen on July 4th at a wavelength of 94 Angstroms (soft X-rays). From "The Sun Now", Solar Dynamics Observatory.

Credit: NASA/SDO and the AIA, EVE, and HMI science teams.

to force two nuclei together. Inside the Sun, the intense pressure is great enough

to heat the hydrogen to over 15 million degrees, giving the nuclei enough energy to overcome their opposite charges, and fuse together. There's a lot of complicated physics going on during these collisions and in reality it takes 3 or 4 separate fusion events to finally form helium but in the end something very strange has happened. The mass of the final helium is actually less than the hydrogen used to make it! This seems very counter intuitive, imagine adding 2 and 2 together and getting, 3.9? What happens to the lost mass is that it is converted into energy in the form of a photon of light! The famous equation $E=mc^2$ tells us just how much energy is released from these collisions and as it turns out, each fusion event releases about 0.000000000004 Joules. That is, as you can see, barely any energy at all and, as most of you could have worked out by now, to match the total energy output of the Sun with fusion events, there must be a truly gargantuan amount of fusion reactions happening every second! And there is! Around 8.5 trillion, trillion, trillion events per second happen within the Sun, meaning the Sun loses about 4 million tonnes of mass per second through fusion and another million tonnes per second in solar wind! It is an astonishing thought that the Sun loses



ASTRONOMERS' TALES

about 2.5 Manhattan's worth of mass a second to produce every photon humanity has ever seen, and at first it seems like quite the worrying thought! I mean, at his at his rate, in a day the Sun loses over 200,000 "Manhattans", and considering the Sun is 4.5 billion years old it seems a wonder there's even a Sun left!

Thankfully, the total mass of the Sun is a number so staggeringly huge, so mind bogglingly massive, that even over its entire lifetime, the Sun has only lost about 0.017% of its entire mass!

So yes! the Sun is "green", could keep 5 Billion Earth sized populations going every second, and loses nearly 200,000 Manhattan's worth of mass every day! The Sun, our local star, is a truly spectacular object! So the next time you're out enjoying its rays this year, be it on the beach, at a barbecue or just in your own backyard, now you know why you might need to keep a bottle of factor 50 close by!

*(I learnt this the hard way when trying to observe the transit of Mercury with my telescope. Although I didn't damage my eyes as I did not observe it directly, and you should NEVER look at the Sun with magnification or without, I did manage to

set my telescope on fire. Actual, burning flames. The Sun is a very dangerous object and you should never try to observe it unless you are fully prepared!)

Finn Burrridge

Sources:

- 1.https://helios.gsfc.nasa.gov/qa_sun.html#tsi
- 2.https://www.worldenergy.org/wp-content/uploads/2013/09/Complete_WER_2013_Survey.pdf
- 3.<http://www.frequencycast.co.uk/howmanywatts.html>
- 4.https://www.windows2universe.org/earth/climate/sun_radiation_at_earth.html
- 5.<https://www.nutrition.org.uk/nutritionscience/obesity-and-weight-management/energy-intake-and-expenditure.html?showall=1&limitstart=>
- 6.<http://www.emc2-explained.info/Emc2/Fusion.htm#.WVZSv4jyuCo>
- 7.http://www.huffingtonpost.com/supercompressor/so-how-much-does-manhatta_b_7503026.html
- 7.<https://briankoberlein.com/2015/12/16/is-the-sun-losing-mass/>





GALLERY

We would love to display your images here, whether they are taken up at Kielder or not - please send them to



newsletter@kielderobservatory.org

along with a brief description of how and when they were taken.



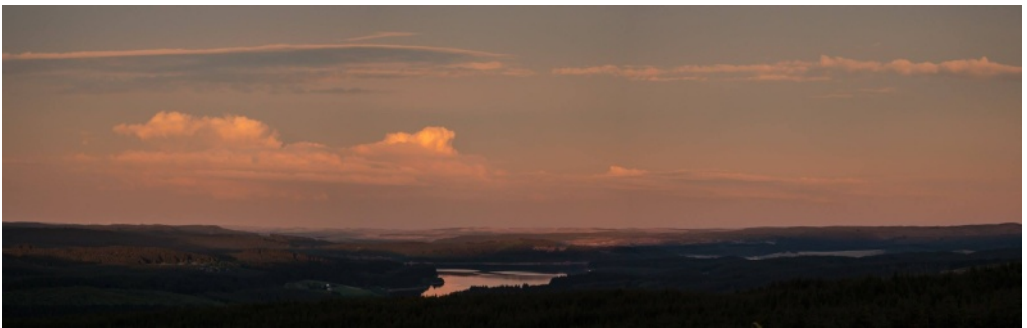
This is the Leo Triplet, a stunning trio of galaxies in the constellation of Leo, easily visible in small telescope. Imaged by the observatory team in April, we can see M65, M66 and NGC 3628. Each one of these galaxies contain hundreds of billions of stars and they're around 35 million light years away in distance. That may sound a lot, but in the grand scheme of things they are really some of our nearer neighbours.



GALLERY



On May 26th the International Space Station passed over the observatory 3 times. It orbits the Earth 16 times a day! The image shows the ISS passing over Jupiter at midnight.



A beautiful summer sunset lights up Kielder Water.



GALLERY



Of course, it does rain occasionally up at Kielder! Here is some evidence.



Iridium flares come from telecommunication satellites that orbit the Earth every 92 minutes. Sometimes their solar panels reflect sunlight directly to the observatory and we see a flash in the sky brighter than the brightest stars.



GALLERY

Jupiter, taken through one of the observatory telescopes in June using a mobile phone. Yes, really!



Here you can see The Milky Way over the observatory, and on the left of the image is another satellite flare!



"A really well organised, interesting and enlightening event. On the face of it going star gazing and not being able to see more than 50 feet could be a bit of a downer, but the evening passed really quickly thanks to the staff (and what I guess is a well enacted Plan B) who were informative and enthusiastic. We probably learnt more about cosmology on our visit there, than going to see Brian Cox the next day."

Dave from
Northallerton

KOAS: Your Window to the Universe

<http://www.kielderobservatory.org>

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