Assessing your subject through public communication skills

Communicating Astrophysics and Space Science

- Why is public engagement important for students?
- Some example slides and exercises
- Student articles and marks
- What is the next step

NOTTINGHAM TRENT UNIVERSITY

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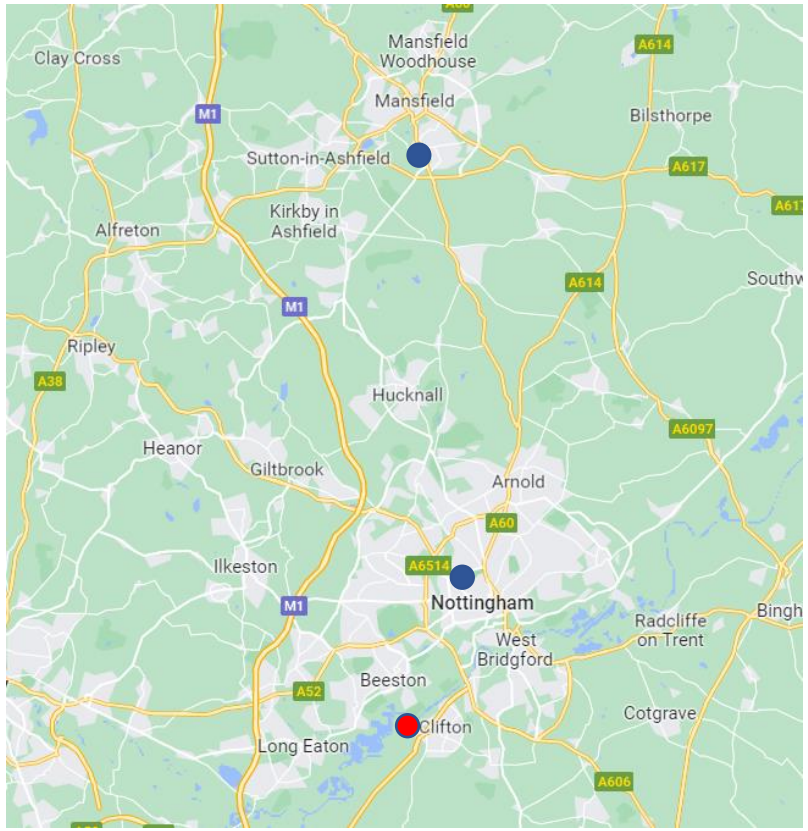
NTU background



- Clifton campus is primarily STEM, Sports Science, and paramedic training

- Imaging facility centre
- On site Observatory
- Nuclear laboratory (including a neutron source)
- MRI 1.5T on campus in a hospital format

NTU physics student cohort

This workshop takes place as lab 2 of 3 in Year 3 module Cosmology: Theory and Observation

- Roughly 20-30 students take this module annually as it is only for BSc Physics and Astrophysics, and MSci Physics students
- ~20% female identifying students
- Lab 1 is data reduction exercise and galaxy size determination
- Lab 3 is a Stellar spectrum star classification exercise
- We have a higher than average number of neuro-diverse students with a high susceptibility to anxiety
- Generally low entry grades: not because they do not know the physics but because they perform poorly at exams
- Low socio economic background, and lots of first generation university students.
- Spend a lot of non contact time doing part time jobs to survive current cost of living

Why is public engagement important for students?

Employability / Recruitment

Attribute	Examples of terms used by STEM professionals for this attribute	% of STEM professionals with this attribute
open-minded	adaptable, embrace change, healthy level of scepticism	48
communicator	diplomatic, good writer, deliver clear presentations	46
logical	critical thinker, analytical, can improve processes	37
domain-specific knowledge	numerate, safety conscious, know the subject	35
curious	ask questions, interest in learning, try new things	33
creative	innovative, inventive, resourceful	33
good colleague	fair, friendly, get on with people	32
resilient	learn from mistakes, don't give up, problem solver	32
collaborative	team player, learn from and with others, supportive	30

The skills they can demonstrate with writing science are useful for the jobs they will go on to do.

More importantly how often will students be interviewed by specialists in their field?

Current students who work with public engagement make excellent student ambassadors!

As alumni they can also be useful in encouraging current students into the job sector.

An online survey of employed professionals and what skills are essential for their job
(Davenport *et al* 2022)

Why is public engagement important for students?

Because we are required to…

"*to present complex information in a clear and concise manner to a range of different audiences*"
(QAA subject benchmark – Physics, Astronomy, and Astrophysics)

"*ensuring a wide variety of types of communication from technical communication through to communicating to a non-specialist audience*"
(IOP accreditation – KE12 transferable skills)

"However, physicists often fall short on broader translational skills, such as effective communication, team working, creativity and the ability to find cross-disciplinary solutions to complex problems"
(Physics World – Jan 23)

It benefits our CPD too!

Provides excellent evidence for assessment criteria in HEA fellowship at all levels

NTU principles – 3 Enriching Society and 6 Empowering People

How is knowledge transferred?

University?

This provides specialist information to you on your subject. Any downsides?

This provides your physics information to a high level but how do you know about other topics?

School: How accurate is your recollection of this?

Think back to your physics lessons, did these describe the principles you now know about well?

What are we left with?

“Trusted sources”

You may know where to find trusted information but what about people who don’t? Where do they get their information from?


SUNDAY EXPRESS

FREE VERY BERRY ICE CREAM FOR EVERY READER baskin robbins WORTH £1.95

WIN! A FORD FOCUS £10K

PLUS FREE SKY TV DOWNLOAD – SLIMMER OF THE YEAR

EXCLUSIVE: DEPRESSION CLUE TO BRIDGEND DEATH RIDDLE

SUICIDES ‘LINKED TO MOBILE PHONE MASTS’


EXPRESS

Home of the Daily and Sunday Express

LOGIN

Apps

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UK | POLITICS | WORLD | WEATHER | SCIENCE | NATURE | ROYAL | WEIRD | SUNDAY

Home > News > Science

Solar flare WARNING: Intense bursts of space weather can DESTROY life on Earth

POWERFUL solar flares and eruptions from the heart of a burning star could render a planet like Earth inhospitable, a terrifying study has revealed.

By SEBASTIAN KETTLEY

PUBLISHED: 16:29, Fri, Feb 1, 2019 | UPDATED: 16:39, Fri, Feb 1, 2019


Mail Online

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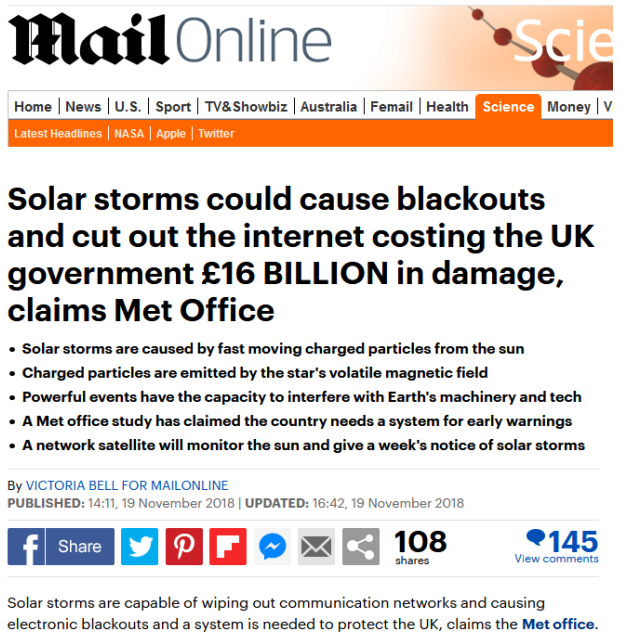
'Super aliens' could feed on cosmic rays: Bizarre forms of life might thrive on radiation that would kill humans

- A rod-shaped bacterium found on Earth lives 1.8 miles underground
- The bug gets its energy from radioactive uranium found in deep mines
- Researchers proposed other forms of bacteria could get energy in this way
- They simulated how bacteria could get energy from cosmic radiation
- The findings open up the possibility of finding alien life forms on planets we previously thought were uninhabitable

By ABIGAIL BEALL FOR MAILONLINE

PUBLISHED: 12:31, 14 October 2016 | UPDATED: 17:43, 14 October 2016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Latest Headlines | NASA | Apple | Twitter

Solar storms could cause blackouts and cut out the internet costing the UK government £16 BILLION in damage, claims Met Office

- Solar storms are caused by fast moving charged particles from the sun
- Charged particles are emitted by the star's volatile magnetic field
- Powerful events have the capacity to interfere with Earth's machinery and tech
- A Met office study has claimed the country needs a system for early warnings
- A network satellite will monitor the sun and give a week's notice of solar storms

By VICTORIA BELL FOR MAILONLINE

PUBLISHED: 14:11, 19 November 2018 | UPDATED: 16:42, 19 November 2018

Share 108 shares 145 View comments

Solar storms are capable of wiping out communication networks and causing electronic blackouts and a system is needed to protect the UK, claims the Met office.

Or even the dreaded YouTube!

What problems does this cause?

“Trusted sources”

Countering bad science is difficult – but entirely possible.

How would you try and provide a counter point to the following videos (to a lay audience)?

…although it’s not all bad!

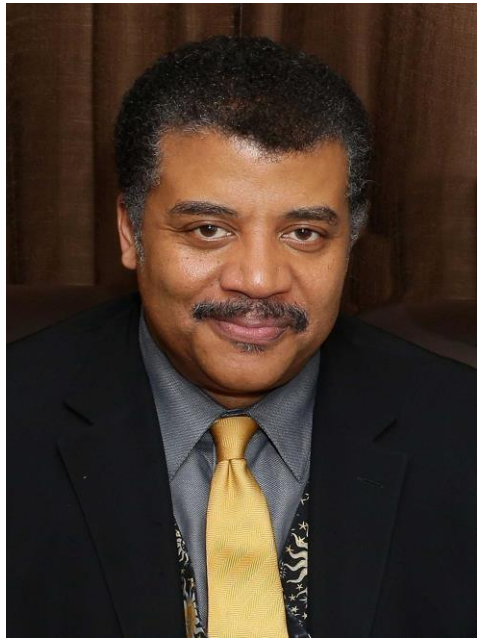
Any positives or negatives you could take away about the **style** of presentation of any of these videos?

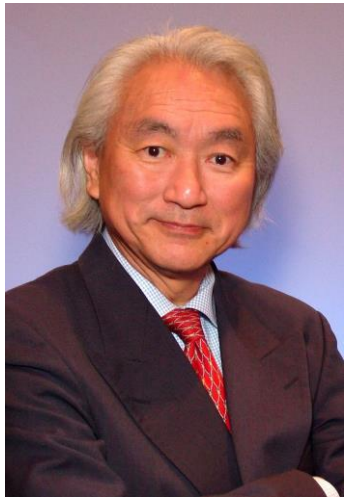
These skills are transferable to writing as well!

Who communicates science well?

Lets hear your suggestions – who do you know who publicly communicates physics?

I suspect you have mostly come up with only a few big names…





Michio Kaku

Jim Al-Khalili

Lucie Green

There are actually lots of excellent physics communicators but they tend to only reach small numbers of people.

Why do you have to communicate science?

- Communicating in a team well
- Working with other disciplines
- Providing education
- Showing your results
- Lets you examine your knowledge for gaps
- Excellent interview practice
- **Builds confidence** in public (or academic) speaking
- It can be a lot of fun!

As professional physicists we have a duty to provide accurate, yet easy to understand information for others.

What does the science community think about public communication skills?

Academic

- How Academic Biologists and Physicists View Science Outreach This study from 2012 basically says that outreach in physics is highly biased on gender, and seen as a non legitimate use of time.
- A project-based course about outreach in a physics curriculum This paper (2016) talks about the skills developed by students when creating their own outreach ideas as part of a module (Project management and group work).
- An Instrument for Assessing Scientists' Written Skills in Public Communication of Science An interesting paper which assesses how scientists communicate. The main areas are: **Clarity**, **Content**, **Knowledge organisation**, **Style**, **Analogy**, **Narrative**, and **Dialogue**.

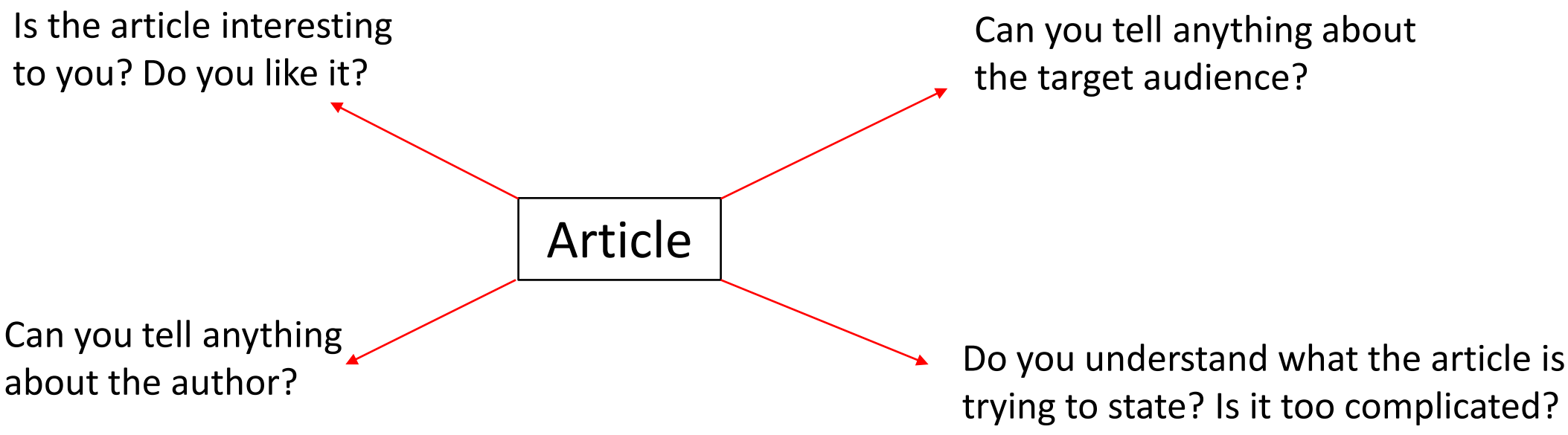
Personal experience

- Practice is key, you will not be amazing on your first (or possible even your tenth) attempt.
- Confidence comes with experience and once you have this it is a lot of fun to do!
- Letting people understand a little of what you know is very rewarding.
- Public communication has massive advantages when it comes to job interviews – you are prepared to talk to people you have never met before and tell them about physics!
- Lets you meet a lot of communicators from other disciplines – can further your own research as well.

Task 1 – critical analysis of science articles

I ask the students to pre-read three anonymous science articles and give them time in class to read them again (maybe the first time!).

We will have a quick read through now and think about each of these **subjective** questions – we will have a Kahoot and group discussion afterwards.



Article 1

Why are there different seasons at specific times of the year?

Over the course of a year, the Earth goes on a journey around the Sun. The reason we have seasons is because, during its journey around the Sun, the Earth is tilted. The Earth's tilt affects the amount of daylight each hemisphere gets, which in turn makes the temperature hotter or colder.

For example, if you live in the northern hemisphere – that's north of the equator, like in Europe, USA, or India – then winter happens in December, January and February. That's when the northern hemisphere is tilted away from the Sun, and the days are shorter.

For anywhere south of the equator, such as Australia or Latin America, it's summer during these months. That's because the southern hemisphere is tilted toward the Sun, and the days are longer.

Solstices and equinoxes

Every season has a middle point. In summer and winter, these midpoints are called solstices. The summer solstice is the longest day, and shortest night, of the year. The winter solstice is the shortest day of the year, and the longest night.

In spring and autumn, the midpoints are called the equinoxes. At the spring and autumn equinoxes, day and night are the same length.

For thousands and thousands of years – right back to the Stone Age – people have known how to work out when the solstices and equinoxes happen throughout the year.

Indeed, they built hundreds of amazing stone circles – like the famous Stonehenge – all over Europe, which marked certain times of the seasons across the year.

These days, we even know how to calculate the seasons on other planets. For example, the next Spring equinox on Mars is on the 23rd March.

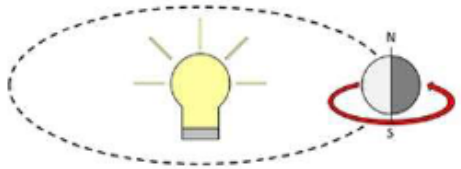
Journey around the Sun

To understand how this works, imagine a small ball (representing the Earth) moving around a lightbulb (the Sun) in a circle. Let's say the ball has a line drawn around the middle, representing the equator. If you have these things at home, you can try this yourself.

As the ball moves around the lightbulb, the half closest to the light will be lit, while the other half will be in darkness. One full circle around the lightbulb represents one full year on Earth.

As you move the ball around the lightbulb, try spinning it between your fingertips, so that the light always shines directly onto the equator.

If the Earth span like this, day and night would be the same length all year round, and there would be no seasons.



No tilt means both hemispheres get the same amount of daylight all year round, and there are no seasons.

The Earth without seasons.

Now, take that small ball and tilt it at an angle, so that the light from the bulb no longer shines directly on the equator. If you are doing this at home, it might help to colour in either the top or bottom half of the ball.

The Earth's tilt

Now the hemispheres of the ball will get different amounts of light at any one time. The hemisphere tilted away from the bulb gets less light, and the hemisphere tilted towards the bulb gets more.

Article 2

What's the weather like on Uranus and Neptune? New images give important clues

The outer region of the solar system may be the least explored, but scientists have managed to unravel several of its mysteries in recent weeks. On New Year's Day, the NASA spacecraft New Horizons encountered the icy object Ultima Thule for the first time, shedding light on how it formed. Astronomers have also just discovered a previously unknown moon orbiting Neptune, which has been dubbed "Hippocamp".

Another discovery, thanks to new images from the Hubble Space Telescope, is that there's a variety of intriguing weather patterns in the atmospheres of both Neptune and Uranus. So what would it be like to go there?

Artist's impression of Neptune and Hippocamp. ESA/Hubble

Having four times the diameter of the Earth, we typically refer to Uranus and Neptune as "ice giants". Unlike the gas giants, Saturn and Jupiter, Neptune and Uranus are lower in hydrogen and helium and higher in concentrations of heavier material such as methane, water and ammonia.

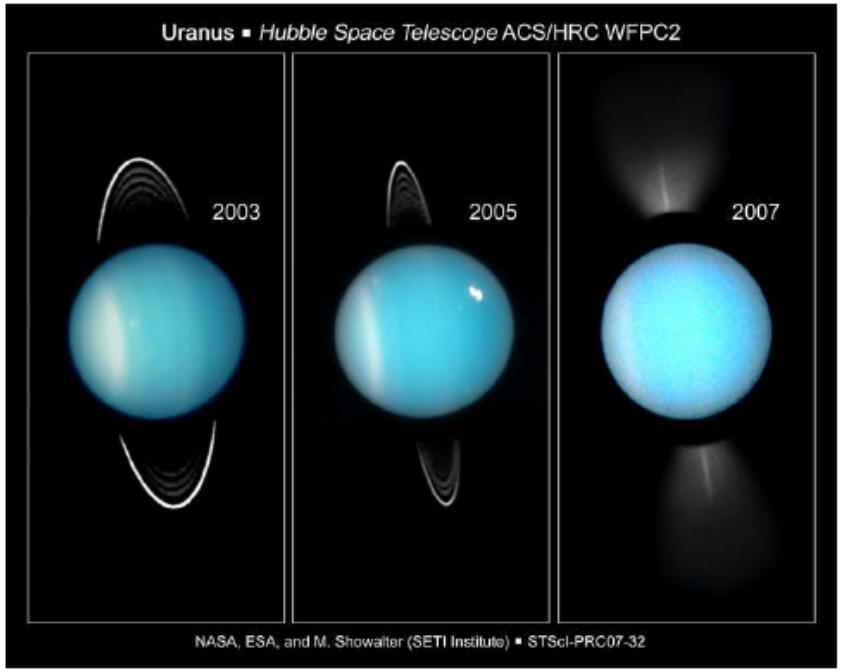
Uranus is especially interesting as it is also the only planet in the solar system that rotates on its side. A northern summer on Uranus lasts 21 years with the north pole receiving constant sunlight, while the south pole sees continual darkness.

This tilt to the Uranian axis is believed to be the result of an early solar system collision with an object at least as large as the Earth. Such a collision would either have released the internal heat reserves of the planet or created a layer of particles which effectively insulate the interior of the planet – preventing heat flow to space. Neptune, having avoided such an encounter, still has an outward heat flow. As such, both planets are almost the same temperature (within a few degrees) despite Uranus being 33% closer to the sun.

Weather on Uranus

The absence of any significant internal heat flow on Uranus means that this planet's atmosphere is distinctly less active than Neptune's. In fact the Uranian atmosphere in winter is the coldest planetary atmosphere in the solar system. When Voyager 2 flew past Uranus in 1986, the planet appeared as a largely featureless green-blue disc. In the years since, however, scientists have realised that even this apparently cold, dead world has a surprisingly dynamic atmosphere.

But the new images from the Hubble Space Telescope show a previously unseen huge white cloud likely composed of ammonia or methane ice enveloping the north pole (see top image). Clearly visible at the edge of this huge cloud system is a smaller cloud of methane ice which rotates around the larger cloud edge. These cloud structures may be seasonal, resulting from the current constant sunlight at the north pole.



Article 3

The Invisible Space Killers: The dangers of space radiation from both inside and outside the solar system.

When we talk about dangerous radiation on Earth the public generally think of short-wavelength electromagnetic radiation such as X-rays and gamma rays. While there are many environmental challenges to the physiology of space travellers, the biggest danger comes from ionising high-energy particles which literally "punch" through spacecraft shielding and cause numerous problems for the human body. But where does this radiation come from and how much danger is there?

Even before the advent of the space race, there was interest in exploring far-off worlds. This included an application form for an interplanetary tour reservation in the magazine "Popular Science Monthly" in August 1952. The names and addresses were to be kept on file at Hayden Planetarium ready for the first space trip. The form even had checkboxes for which planets the applicant wanted to visit! Since then there have been visits to the moon in the 1960s and 1970s, and plans to return to the moon in every decade since.

The idea of a human presence on Mars was first suggested by Wernher von Braun in 1948 and has been the goal of space agencies ever since (Zubrin and Baker, 1991; Williamson, 2017). This destination is significantly more difficult to reach than the Moon due to the travel time and increased fuel required. The time factor means that potential Martian visitors spend longer in a very dangerous environment.

The main risk to human health during spaceflight is ionising radiation exposure, which has been well established as a cause of enhancing degenerative tissue defects when leaving the protection of the Earth's atmosphere and magnetic field.

Of course, even without radiation there are multiple challenges to the human body during spaceflight and time off planet, including muscle loss and a decrease in bone density, as well as less obvious stressors such as the change in the day/night cycle and the effect this can have on circadian rhythms. The human body is conditioned to live on Earth well, but in any other environment, pressure and thermal control will be needed to survive. Meaning humans will always have to be enclosed in some way, whether a capsule, base, or spacesuit.

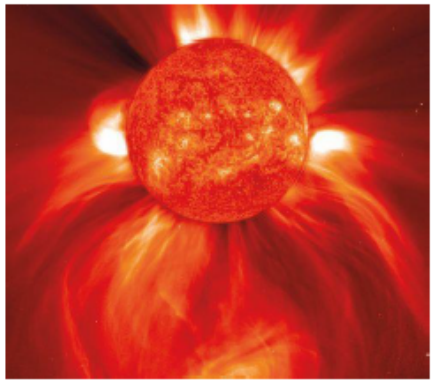
An important first step then is to understand the health risks involved in space travel due to radiation; this will aid in the development of appropriate shielding and allow maximum travel times for future space missions.

The sun as a source of danger

The sun produces a wide range of electromagnetic radiation with a peak in the visible region (specifically yellow). The short, wavelength emission changes through the solar cycle though; a process in which the sun goes from having a magnetic field like a bar magnet, to having a looped and twisted magnetic field at solar maximum, at roughly five and a half years later. The sun then returns to the bar magnet configuration over another five and a half years.

At solar maximum, areas of the sun called active regions are observed that build up solar material before ejecting them out into the solar system. Typically, we see this as a solar flare which includes a large burst of X-rays. These flares can produce X-rays up to 10% of the sun's total brightness. While these can vary, an expected radiation dose is roughly 0.05 Gray due to the very short time of the burst of emission (Thirupathaiah et al., 2019), not enough to be imminently lethal on its own.

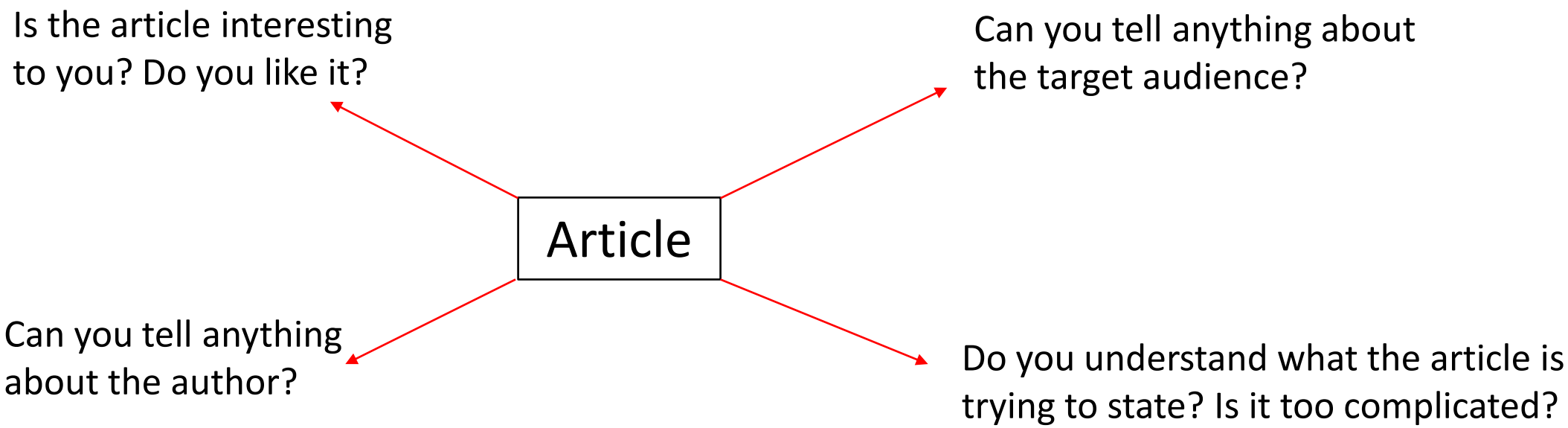
Far more dangerous are the particles which follow such an event called a coronal mass ejection (CME) (Fig. 1). These are very dense clouds of solar material (primarily hydrogen and helium, but many heavier elements are present too) emitted at the same time as the flare. However, while it takes only a few minutes for the X-rays to reach Earth, the CME takes from two to four days to arrive. The impact of CMEs on Earth have been responsible for massive infrastructure damage due to ground-induced currents. Our ability to predict these types of events are still limited. For instance, an immensely strong CME in 2012 which narrowly missed the Earth was only detected because it hit a near-Earth solar observing satellite (Ngwira et al., 2013). The predicted infrastructure damage if this had been a direct event is estimated to be roughly $2 trillion USD. While these events are rare, they pose a serious risk to humans in space as the Earth's magnetic field is not there to protect them.



Back to the slides!

Ok so we have had a read through of the articles; the students usually have plenty of opinions at this point! The Kahoot is well attended and the discussion afterwards is usually focused on the more confident students.

What are **your** opinions on each of the articles though?



Did you guess who the authors were?

Note: some of this number is international language versions of some articles.

The inaugural Professor Sir Paul Curran award for excellence in academic communication goes to …

May 20, 2019 3.27pm BST

Published (44)

ANALYSIS April 25, 2023
Pentagon leaks suggest China developing ways to attack satellites – here's how they might work
19,831 14

ANALYSIS January 20, 2023
Scientists have started steering lightning with lasers – here's how
7,578 1

ANALYSIS December 27, 2022
Five space exploration missions to look out for in 2023
52,489 0

ANALYSIS October 17, 2022
The UK is about to have its first space launch – but Cornwall is unlikely to become a new Cape Canaveral
7,625 0

ANALYSIS April 4, 2022
Ax-1: why the private mission to the International Space Station is a gamechanger
50,842 13

ANALYSIS January 12, 2022
Artemis 1: how this 2022 lunar mission will pave the way for a human return to the Moon
8,025 8

Reach

Overview - All Articles

44 Articles

4,405,931 Readers

1,262 Comments received

22 Comments made

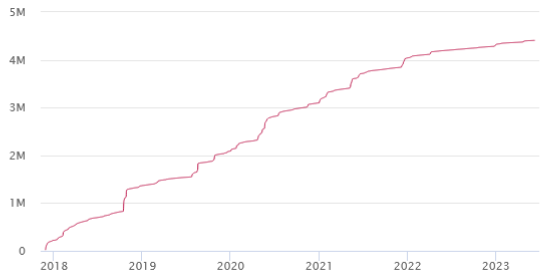
Post Publication Summary

21 Engagements

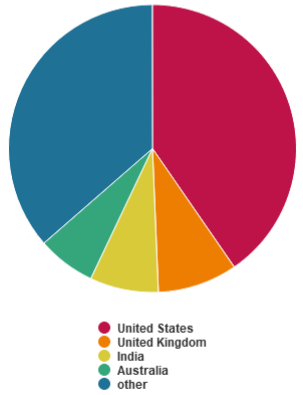
Add feedback

See engagement details

Readers



Country / Territory



Publications

The Conversation

Space.com

Phys.org

My lack of modesty means that all three articles were mine – showing that anybody can write in a range of styles.

Writing style – analogies:

As part of the materials delivered in the synchronous session – I discuss my processes and in particular the use of analogy to aid understanding

In a similar way to modern aircraft legislation, a set of space safety standards and regulations will need to be put in place sooner rather than later. For commercial lunar and beyond

Having four times the diameter of the Earth, we typically refer to Uranus and Neptune as “ice giants”. Unlike the gas giants, Saturn

energy from kinetic (movement) to thermal (heat). The high reentry speeds also produce a shock wave in front of the spacecraft which heats the air to thousands of degrees. This is similar to air heating up in a bicycle pump as it is compressed.

Task 2 – Critical look at articles

Once the material has been delivered on article types etc a second task is ready for the students

Clarity, **Content**, **Knowledge organisation**, **Style**, **Analogy**, **Narrative**, and **Dialogue**

Article 4: Relativistic frame dragging	Article 5: Mass of Galaxy clusters	Article 6: Light pollution and observing

Assessment:

3 Task

Your task is to produce an article on a topic of your choice within the area of space science or astrophysics. This article should be aimed at a scientific literate member of the public.

Writing a public science article is a different task to writing a laboratory report, or an academic paper. You need to pitch your explanation at the right level, and be ready to explain concepts that you might consider obvious. You are free to produce this article in a .docx or a PDF format, the requirements are that you stay within the 1000 word limit and include hyperlinks to referenced material.

An article about any aspect of space science/astrophysics, 1000 word limit
Dropbox submission – provided in NOW documentation

Writing style – formative feedback

Consider what we have already discussed and think about the assessment criteria of Baram-Tsabari and Lewenstein

Clarity, **Content**, **Knowledge organisation**, **Style**, **Analogy**, **Narrative**, and **Dialogue**

What is your target audience?

Is this suitable for the public?

Interstellar reddening produced by micron-sized dust particles selectively dims shorter-wavelength, bluer light more than it does longer-wavelength, redder light, leading to Balmer line ratios that differ systematically from the theoretical predictions. A planetary nebula lying behind a cloud of interstellar dust will be observed to have the intensity ratios H_α/H_β more than 2.86, and H_γ/H_β less than 0.47. The more dust, the greater the disparity between the observed and theoretical Balmer decrements.

Taken from lecture notes at Williams College, USA

How would you phrase it?

Writing style - topics:

Consider what we have already discussed and think about the assessment criteria of Baram-Tsabari and Lewenstein

Clarity, **Content**, **Knowledge organisation**, **Style**, **Analogy**, **Narrative**, and **Dialogue**

You have 1000 words, what can you fit in?

Explainers:	**New science:**	**Future:**
You can fit in one major idea and several smaller adjoining concepts e.g. The life cycle of a star (major) can include fusion (minor), gravity (minor), and temperature (minor).	Give some background history and why it is important. e.g. The launch of Chandraayan-3 by the ISRO. History is that C-1 fell apart after a year, C-2 lander crashed. Importance, India becomes the fourth nation to make a successful soft lunar landing	Where has it been suggested, is it possible, why is it useful? e.g. Solar sails; a sci fi concept that has yet to be fully trialed. Uses green energy only so no rocket fuel. Difficult to return back though

What did students write about?

2020:

- Plasma Cutter from the Dead Space franchise; A Potential Future Development of Today's Plasma Cutters
- The future of private space industry
- Patterned permafrost terrain cracks on Mars and Earth
- How to boil an egg in space
- Could a meteor be the end of all life on Earth as we know it?
- What have the rovers ever done for us
- Can astronomers help avert the end of the world
- Will we take pets to Mars with us?
- Where is everybody?
- The gravity of black holes and their discovery
- Lightsabers, a weapon of the near future
- What we know about galaxies, their types, and how they have evolved
- Could humanity ever reach beyond the Sol system
- The universe is expanding quicker than it should be – and no one knows why
- What we know about the history of the universe
- A viable way to harvest energy from the sun – the Dyson swarm
- Hanny's Voorwerp: How a music teacher had astronomers baffled

What did students write about?

2021:

- The life of a future Titan coloniser
- Pluto: planet or not?
- Could Mars be our future home?
- How SpaceX could harm astronomy and mankind. Starlink and its possible consequences
- Are there any real possibilities for interstellar travel or are we stuck on this planet
- The James Webb Space Telescope: The successor to Hubble
- The Apollo 11 journey: to the Moon and back
- Starlink: Help or hindrance
- Rogue planets, the lonely wanderers
- Io: The most volcanically active world in the solar system
- Magnetars, the stellar magnets
- Why does the sun have acne?
- The restaurant at the end of the Universe: The signature tastes and scents of space.
- The James Webb Space Telescope: The next generation in space exploration
- Warp Drives – our only chance to reach the stars?
- Creating supernova on Earth
- The true image of space
- Powering expansion: harnessing the stars
- Go **ExTTrA** terrestrial with the **Ex**oplanet **T**ourism &**Tr**avel **A**ssociation
- Why the moon changes shape and how it affects our seasons
- Artificial gravity
- Offworld bases: Are they possible? The technology bringing them to fruition and what is it they need.

What did students write about?

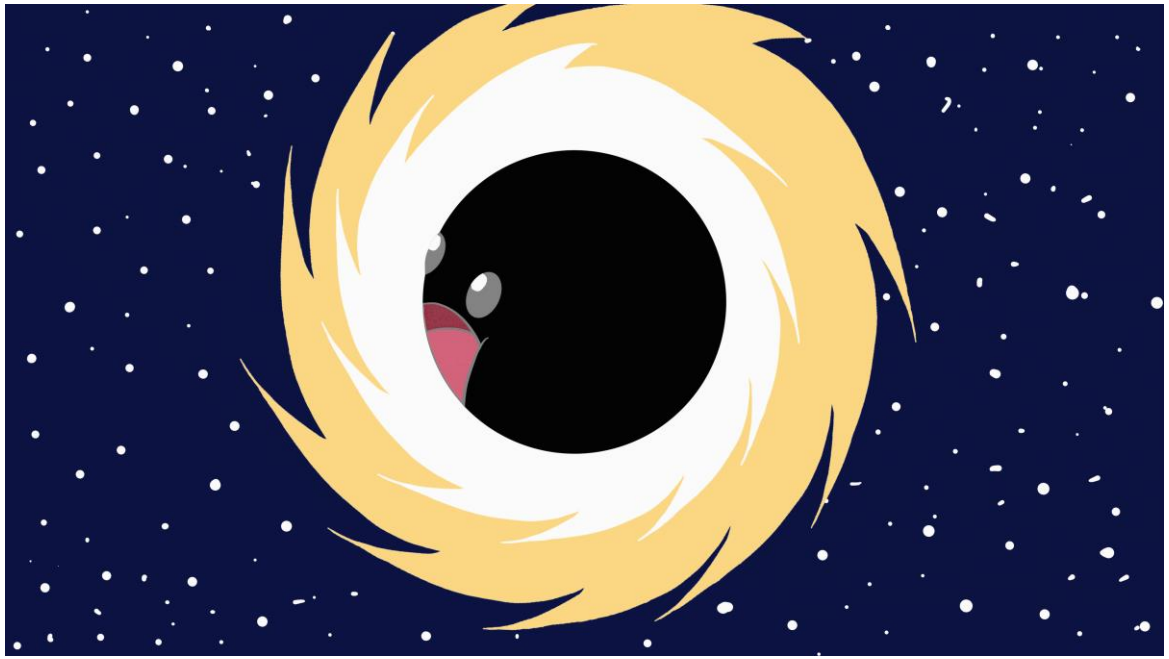
2022:

- The telescope that can look through time
- Finding a new Earth: Detection of Exoplanets and their Atmospheres
- Black hole bombs – Our annihilation sucks
- How can we make Venus a liveable planet for humans?
- Dogecoin to the moon – solving the space currency issue
- Will human settlements offworld ever be possible
- Neutron stars, what are they?
- Energy production of the far future: Dyson spheres, and Dyson swarms
- Finding life on other planets
- Soviet Man in Space (советский человек в космосе)
- Solar sails: The future of space travel
- A look at some of the most expensive out of this world objects
- How to fly in space
- The quarter decade birthday of one of the most important missions to the outer solar system
- Are “Bespin-like” cloud cities on Venus the future of human colonisation?
- Fusion: Future or Fiction
- How the formation of the US Space Force may signal changes in the methods of future conflict
- How to move the solar system: The future of space travel
- Communicating Astrophysics and Space Science

What did students write about?

2023:

- Human life on Mars
- What is inside a black hole
- Is there another you out there?
- Would the vacuum of space kill Fortnite Ninja
- Speedrunning games and rigging elections with space particles
- Is space really that cool?
- The influence of space exploration on fashion
- Using starlight to determine the age of the universe
- The Goldilocks zone
- Astronomical inaccuracies in the Star Wars franchise
- Can you build muscle in space?
- Could Mass Effect's element zero exist?
- Velcro board games? How do astronauts have fun 250+ miles away from the Earth's surface?
- The strobe lights of the universe - Pulsars
- Life on other planets
- What are black holes and why are they so weird?



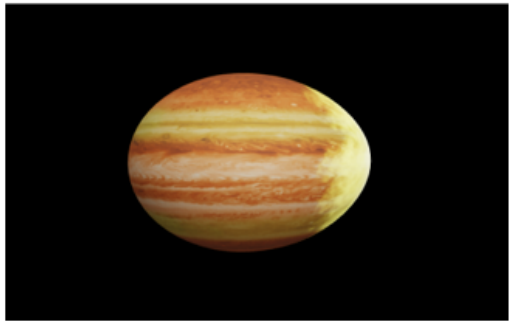
Go *ExTTrA* Terrestrial with the Exoplanet Tourism & Travel Association!

A summary of exoplanet discoveries from a space-tourism company (inspired by NASA's exoplanet posters) by

Hi planet hopper! Thanks for stopping by at one of our ExTTra® branches and picking up this virtual leaflet, we're aware there many interstellar travel companies for you to choose from so we're glad to have you on board! Since our rebranding from the Exoplanet Travel Bureau, we've added a fantastic range of new locations for you to explore with us on our exclusive fleet of FTL2521 model cruisers, all of which are equipped with state of the art warp drives that will allow you to experience the wonders of the cosmos without any that pesky cryogenic freezing hassle.

If you're a fan of Kepler-16b and its two suns you'll love KOI-5Ab, one of our newest destinations which was the first planet to discovered in a triple star system way back 2021 by the TESS mission. Situated approximately 1870 light years from Earth and 7 times the size, this gas giant orbits its parent star KOI-5A once every 5 days with the nearby KOI-5B forming a binary star system with an orbital period of 30 years. These two stars are joined by KOI-5C, which orbits their system at a leisurely rate of 400 years. As a visitor to this planet, you can expect to be met with some of the most spectacular sunsets and sunrises in the universe, and as these three stars dance around in the sky, so will your shadow!

For those looking for little bit more excitement on their intergalactic getaway, why not visit WASP-12 b or HD 189733 b on one of our high-octane deadly planet safaris! These are two Gas Giants with some extreme environments that you and your fellow passengers can experience in complete safety*. Far above the scorching 2200 degrees Celsius surface of WASP-12 B, passengers can witness a massive planet with almost twice the radius of Jupiter getting its atmosphere slowly depleted by a star that is just 0.02AU away, that's 20 times closer than Mercury is to the Sun! Upon approach passengers will also be able to see how the extreme gravity and tidal forces being exerted on the planet by its star are stretching it into an egg shape, whilst also "stealing" its orbital energy so that the planet will eventually spiral into the star, but we should have a good 3 million years before that happens.



The "egg" shaped WASP12b (image https://exoplanets.nasa.gov/resources/2212/wasp-12b-3d-model/)

Want to get a bit closer to the action? Then the next stop on our deadly planet tour will be a blast, as HD 189733 b is another near Jupiter size gas giant just 63 lightyears from earth with a truly awesome weather phenomenon. Much like our previous stop, HD 189733 b is very close to its parent star (HD

I encourage the students to forget tradition!

What have the rovers ever done for us?

A distant voice from the red planet.

By

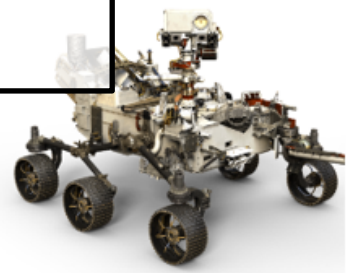


Image credit: nasa.gov

It's early December 2022, a red dust covered automated vehicle trundles across the barren wind driven rusty landscape of the Jezero Crater, the site of an ancient lake and river delta, returning samples to a cache.

"They spent $2.5 billion and over 6 years on me, and what do they get me to do? Collect rocks and dust. I've been here for 687 Earth days, although I've seen the sun rise 669 times. Just one year they said. Didn't tell me it was a Martian year! I was sent all this way to 'Study Mars' Habitability, Seek Signs of Past Microbial Life, Collect and Cache Samples, and Prepare for Future Human Missions'."

amplifier, the earliest use of that camera technology was with old Uncle Luna-4 in 1963. Some of *my* images are in x-ray of the micro-structure of soils, some in 3D of the surrounding landscape."

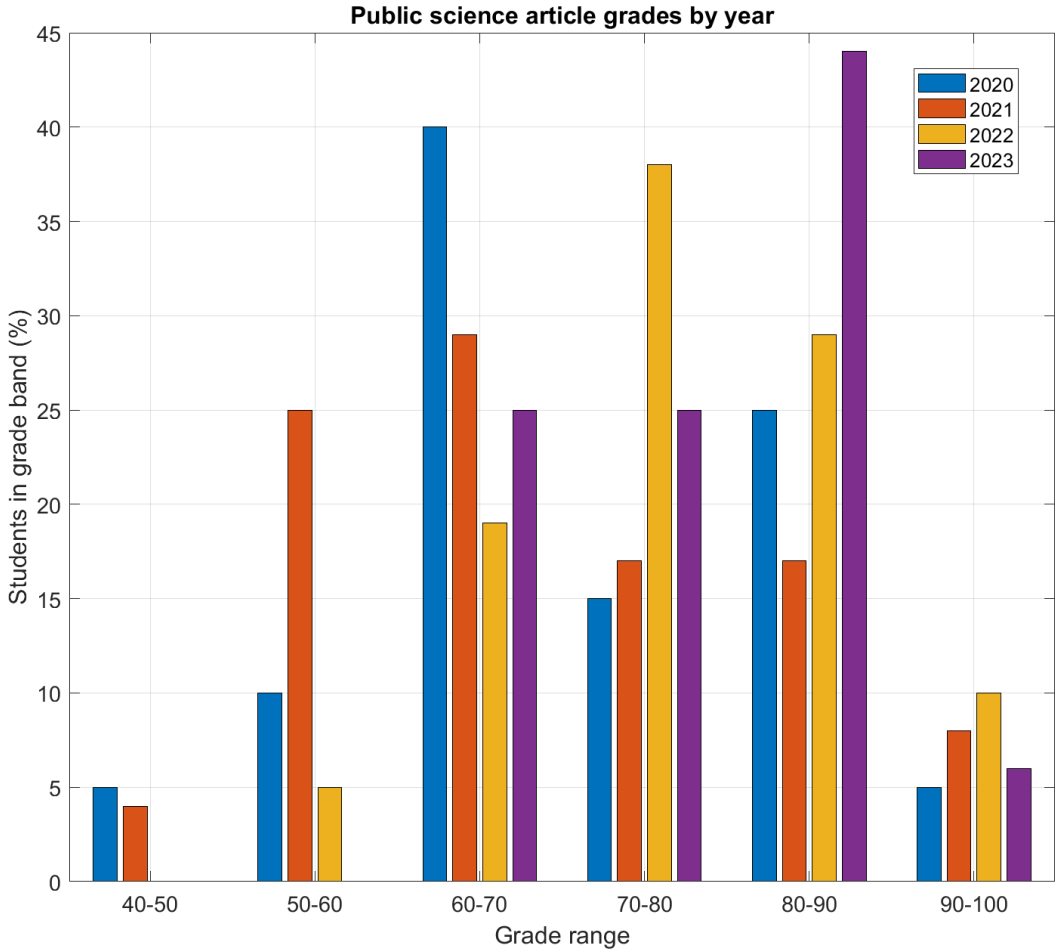
"Having stereoscopic vision helps me avoid pitfalls and not get stuck in the wind-blown dust. Although it didn't help Spirit, still stuck south and east from me. What a way to end up, after living 20 times longer than his predicted 90 sol, climbing out of the Gusev Crater and then climbing Columbia hills to be left in a dune. His stable mate Opportunity fared much better, about 80° west from me at Meridiani Planum, also in the northern hemisphere (just). He set the record for the furthest travelled rover at over 45 km, and sent a panorama (1 amongst many) from one of the highest spots on Mars. The way we have all moved around this landscape so far from human intervention is helping with driverless car technology, and some of our poorer cousins have been used to explore dangerous places on Earth, like Fukushima and the hadal zone. Oppy and Spirit both found evidence of a possibly warmer and wetter past on this old dust bowl of a planet."

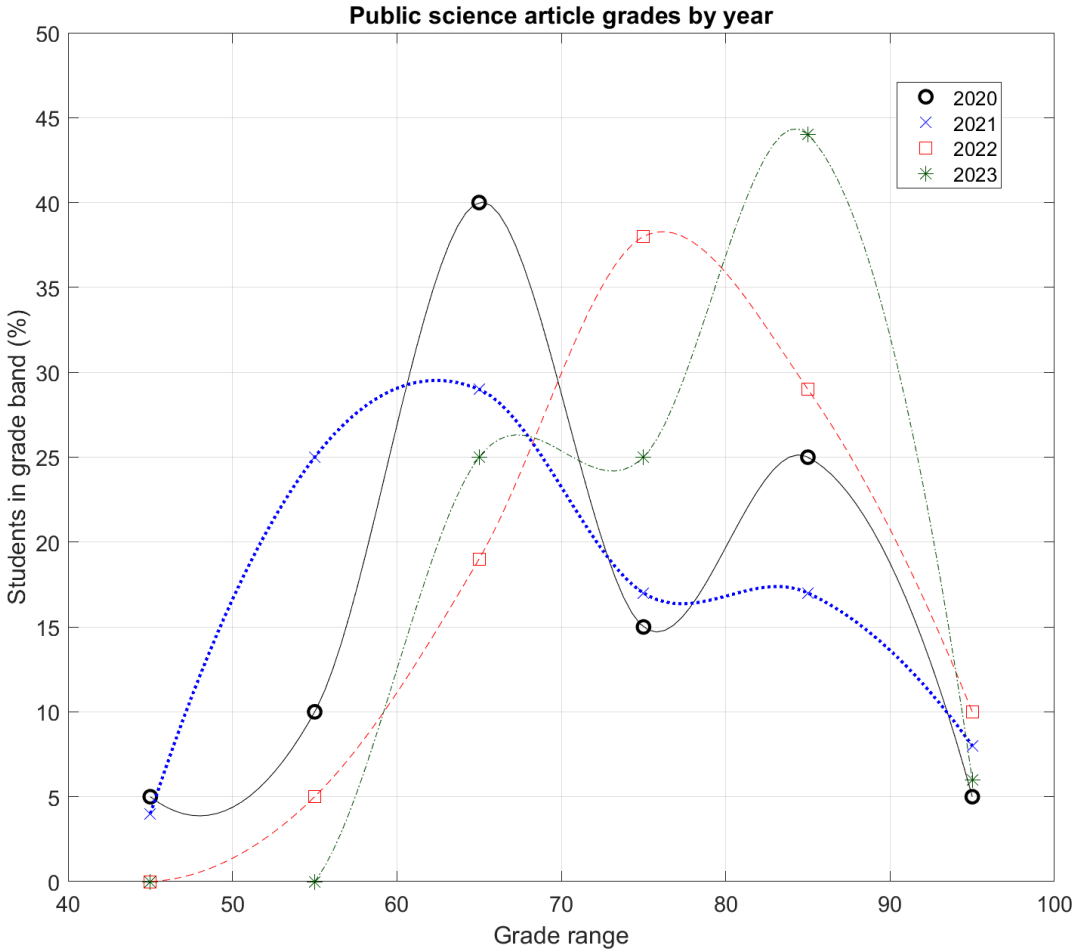
"I've sent hours of recordings of the sound of the wind and myself as I tried to stay warm. I've recorded endless data on the temperature. Mostly cold, like -63°C, with the midday Sun warming me to a more palatable 20°C while the UV tries to disassociate me. Thankfully I'm not organic; although I hear

Student grades

You may have noticed some similar topics popping up…

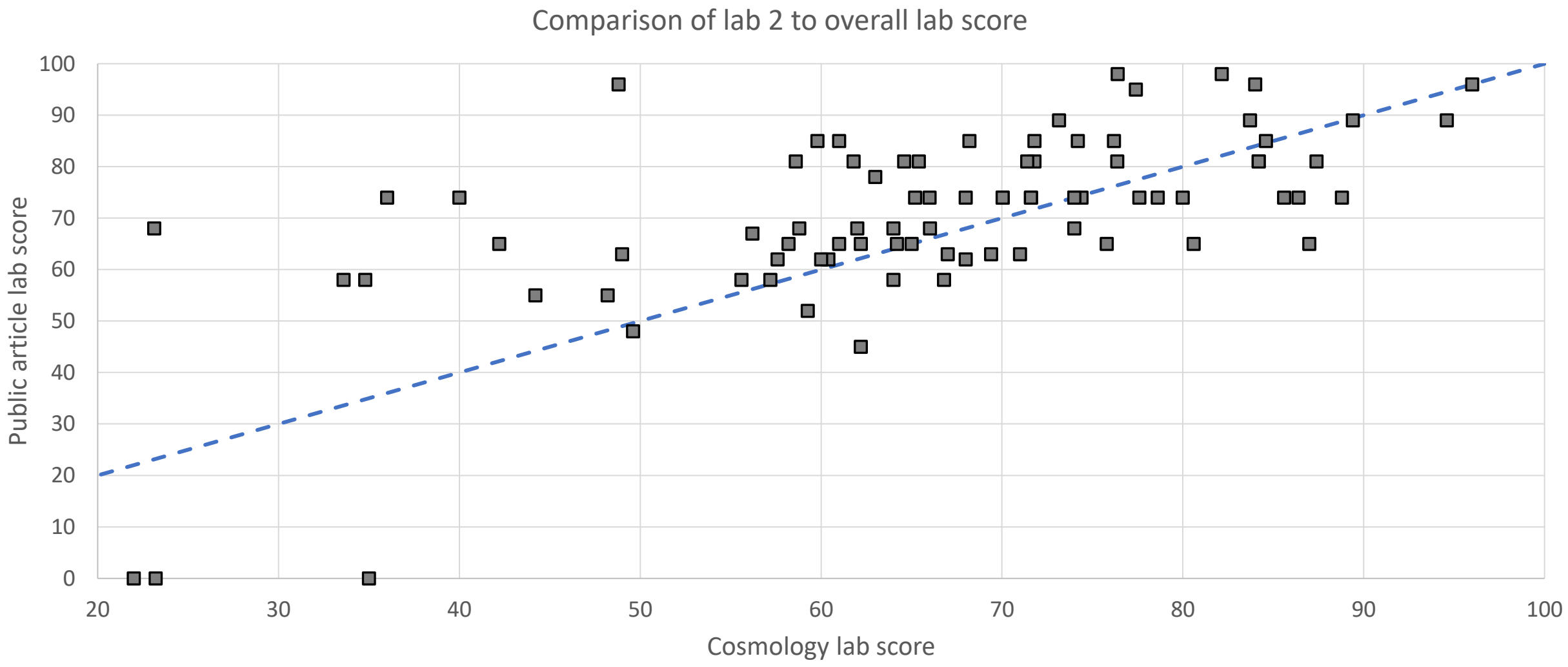
These are not penalised at all but do affect the markers subconscious feeling towards the article – which I do my best to ignore!



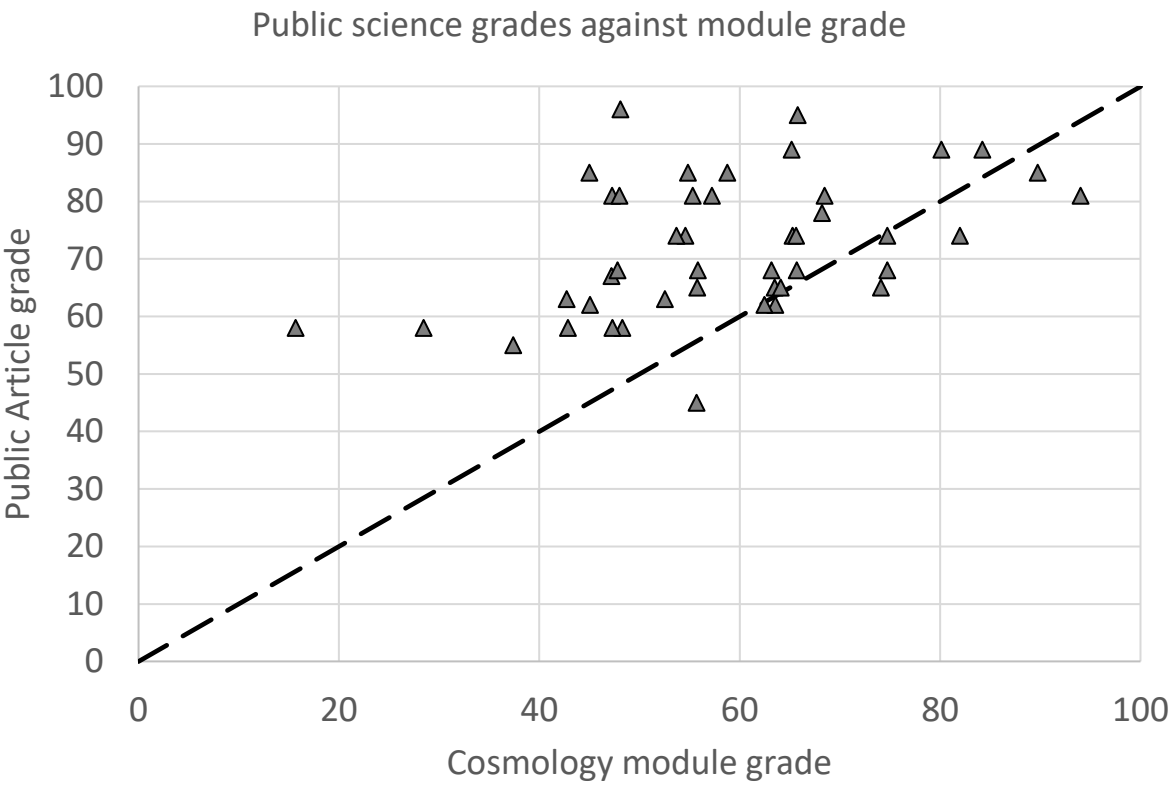


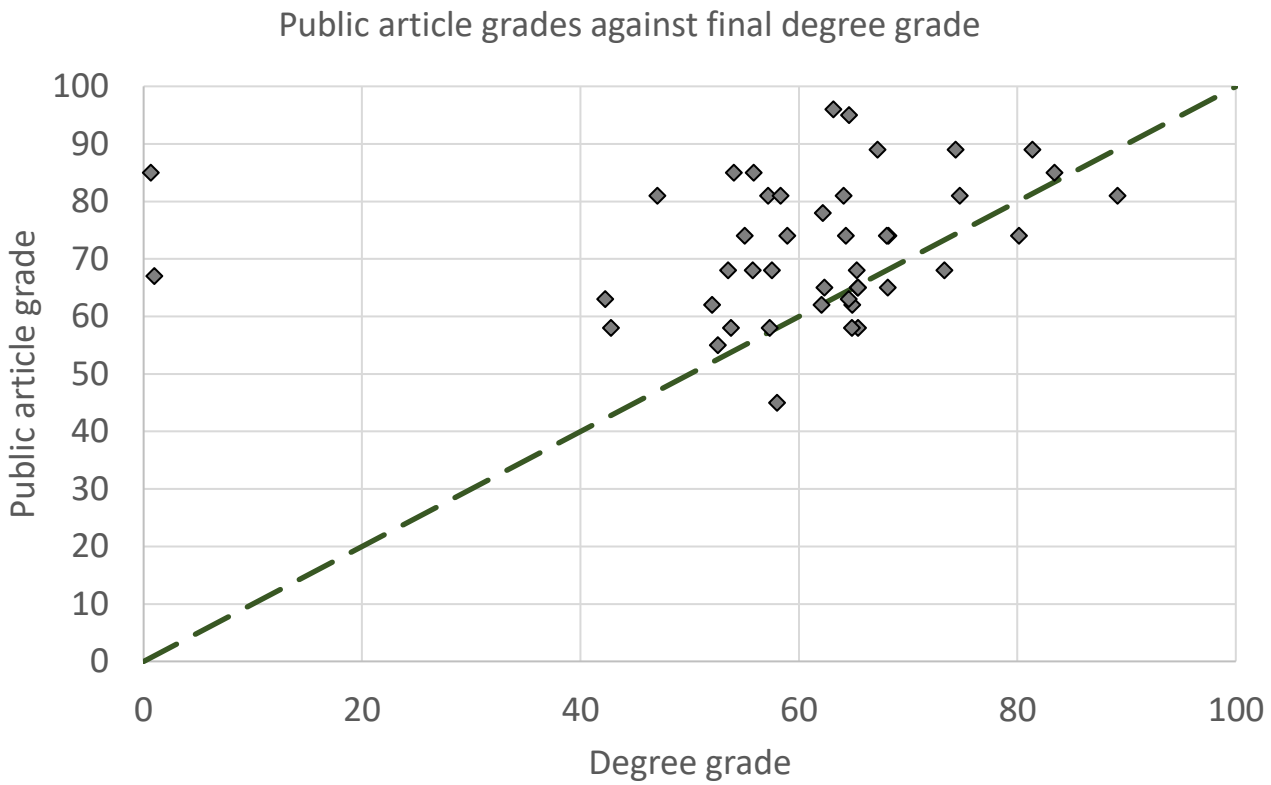
Student grades

Blue line shows matching scores across Cosmology labs generally and the public science article – all 4 years



Student grades





The line of unity shows that this assessment does no harm to final grades but does help those students who are achieving mainly 40-50% in modules.

GBA:

- Not easy to mark as there is subjective assessment involved
- All five areas are equally weighted
- Description is planned to be succinct yet clear for the students
- How do you judge interest?

Student number				Final mark		
Marking Criteria	**First**	**Upper Second**	**Lower second**	**Third**	**Fail**	**Zero**
Level of Detail	Delves into relevant complex topics and ideas without confusing the issue. Opinions are included as well as fact	Complex topics are attempted with good explanations, consideration is given to alternative points of view	A reasonable article that provides some novel information, potential for slight confusion over topics or a very linear approach	The article begins to look in detail on a topic or point of view	The article provides an overview of a topic and is largely public common knowledge	No submission
Engagement	An article that fully shows the importance of the topic, the narrative is clear and guides the reader through.	An article that engages the reader, encouraging them to read more on the topic	A reasonable level of interest for an appropriate reader	The article is largely formulaic	The article reads like a scientific journal paper or a lab report	No submission
Accessibility	All terms are explained and the text provides a clear/novel description of the topic.	All terms are explained, and the level of language is appropriate.	All terms have been described but not in an easy manner	A few terms/equations have not been described	The article contains terms not explained or innapropriate. Equations are not justified/explained	No submission
Quality of writing	An article that contains a wide range of correctly used vocabulary	An article that contains good English and a range of vocabulary.	A mostly correctly spelled article but low level of English.	Some spelling and quality issues	Poor level of English/Spelling	No submission
References	All references are appropriate and work, the number of references do not slow the reading of the article down	References all linked correctly, Either slightly too many or too few references.	References mostly work and are relevant to the article	The references are either poorly placed or innapropriate, some links don't work.	References are either incorrect or not hyperlinked	No references
Word Count		Within 1000 words? (capped at 3 high if not)				
Feedback:						

Tips provided to students:

1. Make it interesting! This is the most important point here…
2. Practice writing different bits
3. Test your skills on your family or non-physics friends do they get what you are talking about?
4. Consider writing a science blog or doing some YouTube videos – potentially reader articles in online newspapers
5. Think about your audience level, maybe read other articles aimed at that group.
6. If you use an equation or two make sure you explain what it is, and what its purpose is.

Take away points:

- Try something creative with student assessment
- You don’t have to be an expert to have a go at subject communication
- The students are really good at feeding back what is good communication and what is not
- Poor science does not mean poor communication skills!
- I need to find a way of getting these articles available to the public…

Thank you and any questions?