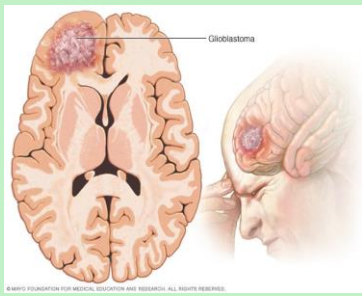
22/01/25

THE LAB REPORT

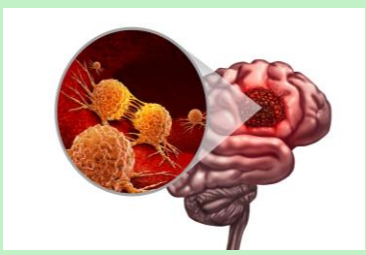
Today's joke
A hotel receptionist asks if the photon has any luggage...

Scientists run rings round aggressive brain tumours

Glioblastomas are a type of brain tumour that originate in the brain itself (known as primary tumours) rather than spreading there in the later stages as with many other cancers. According to the World Health Organisation, glioblastomas are classed as grade 4 (the highest grade), meaning they are fast- growing and highly likely to spread to other tissues in the brain. They are the most common high grade primary brain tumour in adults, and sadly the prognosis for glioblastoma is poor; the average survival time for patients is 12-18 months, only 25% survive more than a year and only 5% survive more than 5 years.



However, promising research conducted by international scientists has increased our understanding of the growth of these tumours, and may even enable earlier diagnosis of glioblastoma, as well as allowing its progression to be better tracked and treated. The study, which was led by Dr Benjamin Werner at Queen Mary University of London and Professor Paul Mischel at Stanford University, revealed rings of DNA outside of chromosomes, known as extrachromosomal DNA (ecDNA) that contain cancer-driving genes, making tumours more aggressive and resistant to treatment, and often arriving early in the tumour's development or even before they're fully formed. As a result, blood tests could be developed that detect these genes early on, providing 'a window of opportunity' to detect and treat the onset of the disease before it becomes more aggressive, potentially even tailoring treatment to tumours based on their ecDNA profile.



By Eloise Martin

BIOLOGY

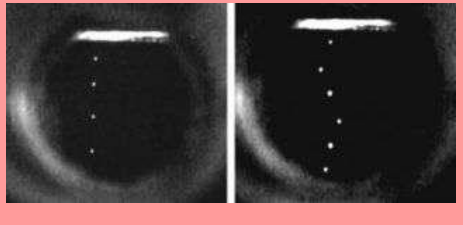
Read more ....

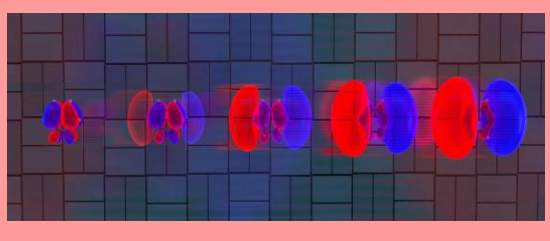
Electron spotting anyone?

In a groundbreaking discovery, for the first time ever, scientists have managed to watch a single electron move during a chemical reaction!
This amazing discovery was made by a team of researchers in the USA.

They used a high-resolution X-ray laser to take incredibly rapid and successive "photos" of a molecule breaking apart — faster than one millionth of a billionth of a second to be more precise. This has finally allowed them to see how an electron jumped from one part of the molecule to another as the particle reacted.

Electrons are the reason atoms can bond and reactions can take place. But until now, scientists could only theorise where electrons were during reactions but they had no physical proof.
By capturing this motion, researchers now have a new way to understand how chemical reactions really work. This could help design better medicines, cleaner fuels, and new materials in the future.
It's like finally being able to watch the invisible hands behind every chemical change!

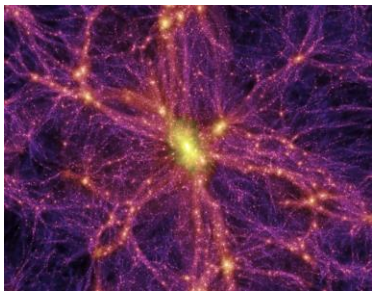




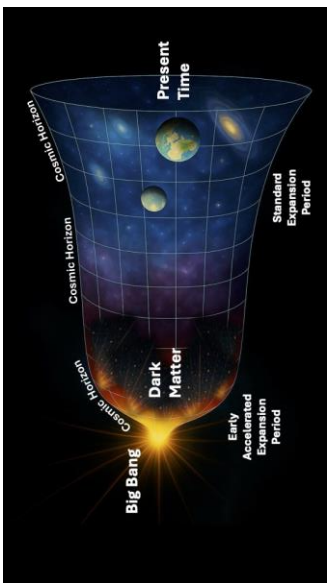
By April McGowan

CHEMISTRY

Dark Matter Catcher



PHYSICS



About 80 percent of the universe's mass is thought to consist of dark matter. And yet, little is known about the composition and structure of the particles that make up dark matter, presenting physicists with some fundamental questions. To explore this elusive matter, researchers are attempting to capture photons, or light particles, which are produced when dark matter particles collide with the visible matter we are familiar with.

Up until now, experiments have focused on dark matter particles with similar masses to our already known particles. If a particle is lighter than an electron, it is very unlikely that it would be detectable with our current equipment, causing no experiment so far to succeed in directly detecting dark matter. However, this in of itself is an important finding as it shows that dark matter particles don't exist within the range of masses tested.

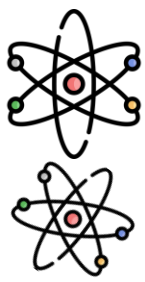
An international team from the University of Zurich's Department of Physics has now been able to probe the existence of dark matter particles as light as one tenth of the mass of an electron using an improved superconducting nanowire single-photon detector.

The detector works as when a photon strikes a superconducting nanowire within the device, it heats up slightly and causes it to instantly lose its superconductivity. This wire briefly becomes a regular conductor and the resulting increase in electrical resistance can be measured.

Most recently, they swapped the nanowires with microwires in order to maximise the detectors cross section. They also gave the device a thin shape so that it is highly sensitive to changes in direction. Scientists assume that the Earth passes through a "wind" of dark matter, and the particle's direction will then shift over time, so having a device capable of picking up directional changes, it can help to filter out non-dark-matter events.

As we slowly advance this new and experimental technology, we could eventually find out all the secrets of our universe.

By Henry Cleverdon



Cold lava?!

GEOLOGY

In the Arusha region of northern Tanzania there is a volcano that produces a completely unique type and composition of lava unlike any other in the world. Ol Doinyo Lengai is an active stratovolcano, 16km south of the dangerously alkaline lake Natron. The volcano is located in the Gregory rift, a section of the active East African rift. The volcano has only one active cone on its north side which formed around 15,000 years ago.

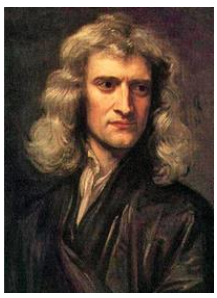
Ol Doinyo Lengai is the only active carbonatite erupting volcano in the world, and the only volcano to ever erupt natrocarbonatite (natro- refers to the high sodium content). Carbonatite lava is an incredibly rare form of lava that contains less than 3% silica by mass, giving it an ultra-low viscosity, even less than the stereotypically runny pahoehoe lava in Hawaii. Natrocarbonatite lava can travel at up to 30mph and has a shockingly low temperature (for lava) of just 500°C! Its glow is so faint that it can only be viewed at night and with long-exposure cameras.

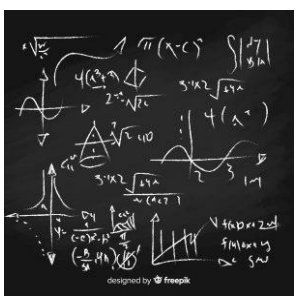
Uniquely, when the volcano erupts and the lava cools, the lava changes colour from jet black to bright white within only five days due to the rapid hydration of the unstable carbonate minerals in the lava, giving the appearance of snow on the volcano!

To give an idea of just how "cold" this lava is, in 2007 a local porter named Pambao fell into an active lava flow on the volcano and miraculously climbed out before being carried down the volcano by the rest of his team. After a couple of years he made a full recovery, despite losing both of his legs.

This one-of-a-kind volcano provides an exciting glimpse into the geochemistry of Earth and other planets (especially carbon-based ones). How cool!

By Alejandro Iglesias-Whittaker





Our new maths section!!!

MATHEMATICS

Maths: a discovery or invention?

Simple mathematical ideas first made an appearance over 30,000 years ago, with bones carved with what looked like modern-day tally charts. This evolved into a real counting system in Mesopotamia, in 3000BC, where they used clay tablets for financial records. At Yale University is a very well-preserved attempt from this period to calculate the value of $\sqrt{2}$ (and it is shockingly precise!). All of this is to say that maths has been around basically forever. But did we as humans create it, or is it innately weaved into our universe?

The first widespread development in maths (past basic arithmetic and geometry) was Pythagoras' Theorem, and people believed that numbers were living entities and universal principles. Plato argued that they would exist without our knowledge of them and Euclid stated that nature came about due to mathematical laws. So, it seems ancient philosophers all agree that maths was something to be discovered, not invented.

However, more recent mathematicians claimed that while the ideas may be something already there in our universe, the notation and formulae we use to describe them are all manmade, with Leopold Kronecker saying, "God created the natural numbers, all else is the work of man". Famously in the late 1600s, calculus (the maths of how things change over time) was 'invented' separately yet at the same time by Isaac Newton and Gottfried Leibniz. Many say that this simultaneous invention implies it is not an invention at all but a truth waiting to be found.

Maths crops up in so many unexpected places, from the Fibonacci sequence in flower petals to bees building honeycomb in hexagonal structures to maximise efficiency. One specific example is the North American Periodical Cicada, which only ever lives a prime number of years to ensure its emergence never coincides with that of its predators which helps it survive in nature.

So, invented or discovered? The most agreed upon stance is in fact... both. In a philosophical sense, many mathematical concepts seem to be built into everyday life without having to be invented by someone. Even so, the language and symbols we use to describe them were undoubtedly invented by humans.

By Emily Ford

REVISION TIPS

Cornell notes

Key words	Notes
Cornell notes	Cornell notes are a structured way of taking and reviewing notes. You can divide you page like so, filling each section with the respective info.
When can I use them	You can make them live, during class, or after when you want to consolidate your free-form notes.
How to use them actively	To use them actively you can cover the notes section and try to explain your key words/prompts. This forces active recall letting things stick a bit more than just re-reading information.

Summary

Here , you write a short paragraph summarising your notes in your own words. This helps you check your understanding and is a quickfire way to remind you of topics in limited time.

By Delaena Debre

Find out about
The Lab Report Competition on the next page

Today's joke

The photon says, "No, I'm travelling light!"

Want to get involved in The Lab Report? Now's your chance!

We're challenging you to write a science-based article in an area that interests you, and we'll pick the best two to publish next issue. The article must be around 200 words, complete with a picture, and sent to TheLabReport@ccgrammarschool.onmicrosoft.com by 10th October. Please make sure you credit yourself with your name and form group. Good luck!

That's all from us , see you in our next issue !

April McGowan, Clove Gater, Emily Ford, Freya Windle, Samuel Johnson, Eloise Martin, Hermione Redwood, Ron Zaki, Delaena Debre, Henry Cleverdon, Alejandro Iglesias-Whittaker

Edited by Emily Ford