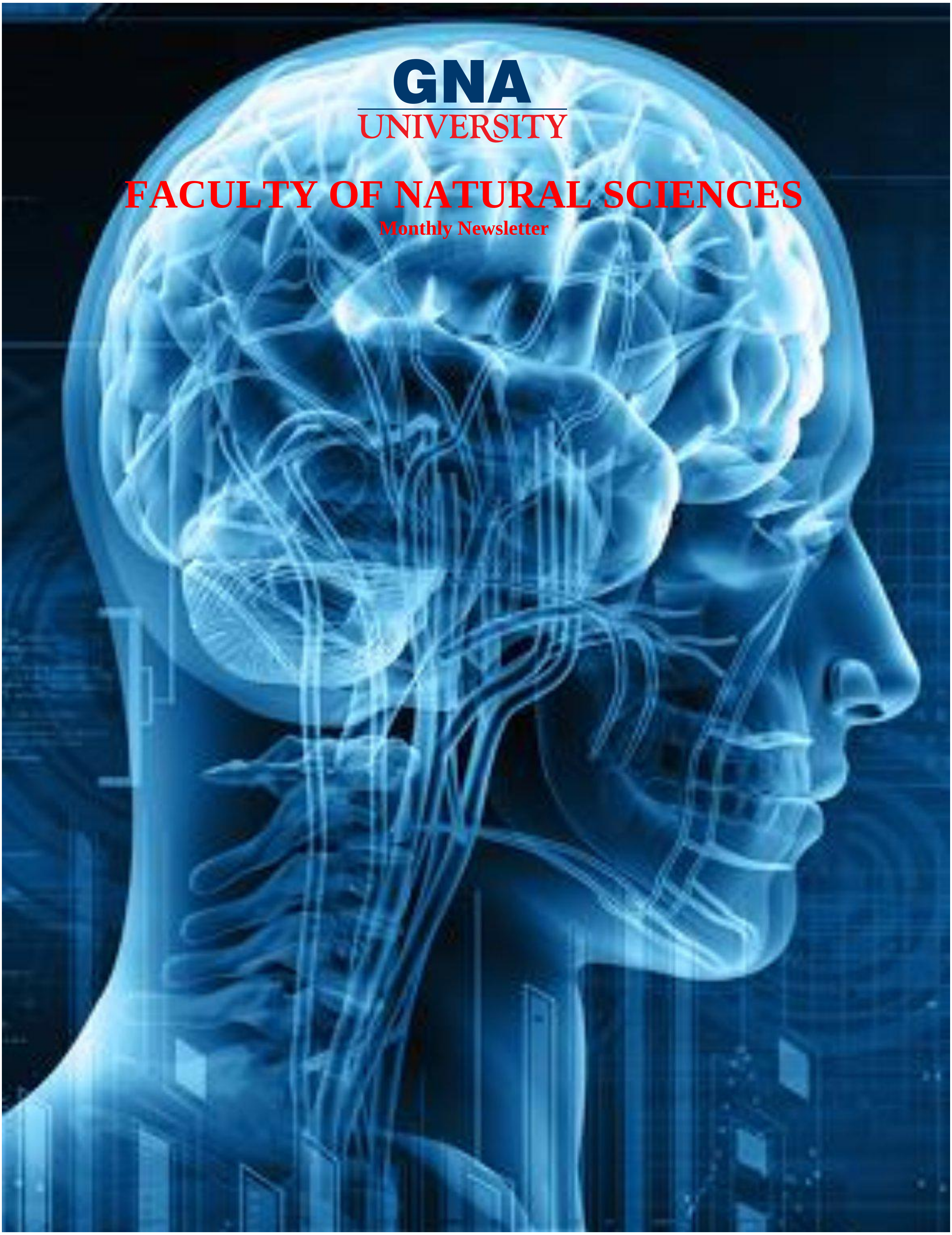

GNA UNIVERSITY

FACULTY OF NATURAL SCIENCES

Monthly Newsletter

From Editor's Desk

The main objective of "Science Review", A monthly newsletter of Faculty of Natural Sciences is to improve the knowledge base and skills in addressing the issues related to science, focusing mainly on them as well as promoting scientific societies in the university. The content of this newsletter focuses on advances in Physics, Chemistry and Mathematics and various activities going on in the faculty by faculty members and students. This is an opportunity for faculty members to have a good overview of the issues related to the subjects. I extend my warmest thanks to the faculty members for their interest, enthusiasm and timely submission of content write-up and participation. As Editor of "Science Review", I anticipate that this issue would be of immense value and will be definitely useful to the faculty in natural sciences. This collection will also offer a window for new perspectives and directions in the area of palliative care in the readers' mind for long.

Edited By: Dr.NeerajPuri
Ms. ShikhaBatish
Design Concept: Abhineet Goyal

Image Source: https://discuss.fm/w/science

A Digital monthly Newsletter of Faculty of Natural Sciences, GNA University, Phagwara

Definition of Terms: Model, Theory and Law

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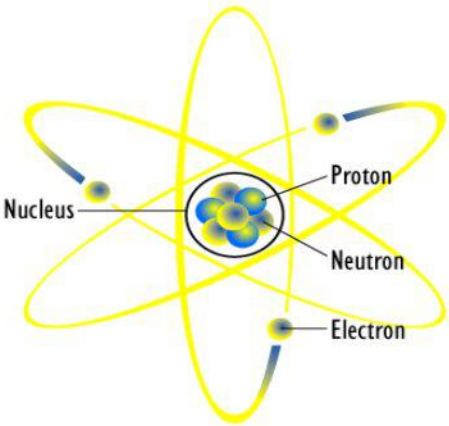
In colloquial usage, the terms model, theory, and law are often used interchangeably or have different interpretations than they do in the sciences. In relation to the study of physics, however, each term has its own specific meaning.
The laws of nature are concise descriptions of the universe around us. They are not explanations, but human statements of the underlying rules that all natural processes follow. They are intrinsic to the universe; humans did not create them and we cannot change them. We can only discover and understand them. The cornerstone of discovering natural laws is observation; science must describe the universe as it is, not as we may imagine it to be. Laws can never be known with absolute certainty, because it is impossible to perform experiments to establish and confirm a law in every possible scenario without exception. Physicists operate under the assumption that all scientific laws and theories are valid until a counterexample is observed. If a good-quality, verifiable experiment contradicts a well-established law, then the law must be modified or overthrown completely.

Models

A model is a representation of something that is often too difficult (or impossible) to display directly. While a model's design is justified using experimental information, it is only accurate under limited situations. An example is the commonly used "planetary model" of the atom, in which electrons are pictured as orbiting the nucleus, analogous to the way planets orbit the Sun. We cannot observe electron orbits directly, but the mental image helps explain the observations we can make, such as the emission of light from hot gases. Physicists use models for a variety of purposes. For example, models can help physicists analyze a scenario and perform a calculation, or they can be used to represent a situation in the form of a computer simulation.



Planetary Model of an Atom

Theories

A theory is an explanation for patterns in nature that is supported by scientific evidence and verified multiple times by various groups of researchers. Some theories include models to help visualize phenomena, whereas others do not. Newton's theory of gravity, for example, does not require a model or mental image, because we can observe the objects directly with our own senses. The kinetic theory of gases, on the other hand, makes use of a model in which a gas is viewed as being composed of atoms and molecules. Atoms and molecules are too small to be observed directly with our senses—thus, we picture them mentally to understand what our instruments tell us about the behavior of gases.

Laws

A law uses concise language to describe a generalized pattern in nature that is supported by scientific evidence and repeated experiments. Often, a law can be expressed in the form of a single mathematical equation. Laws and theories are similar in that they are both scientific statements that result from a tested hypothesis and are supported by scientific evidence. However, the designation law is reserved for a concise and very general statement that describes phenomena in nature, such as the law that energy is conserved during any process, or Newton's second law of motion, which relates force, mass, and acceleration by the simple equation F=ma. A theory, in contrast, is a less concise statement of observed phenomena. For example, the Theory of Evolution and the Theory of Relativity cannot be expressed concisely enough to be considered a law. The biggest difference between a law and a theory is that a law is much more complex and dynamic, and a theory is more explanatory. A law describes a single observable point of fact, whereas a theory explains an entire group of related phenomena. And, whereas a law is a postulate that forms the foundation of the scientific method, a theory is the end result of that process.

Reference: Boundless. “Models, Theories, and Laws.” Boundless Physics. Boundless, 26 May. 2016. Retrieved 18 Jul. 2016 from https://www.boundless.com/physics/textbooks/boundless-physics-textbook/the-basics-of-physics-1/the-basics-of-physics-31/models-theories-and-laws-195-6078/

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Surface Tension Can Sort Droplets for Biomedical Applications

Ms.Pawanjeet Kaur
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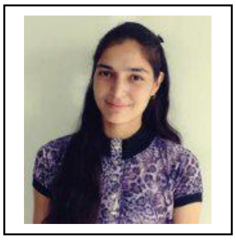
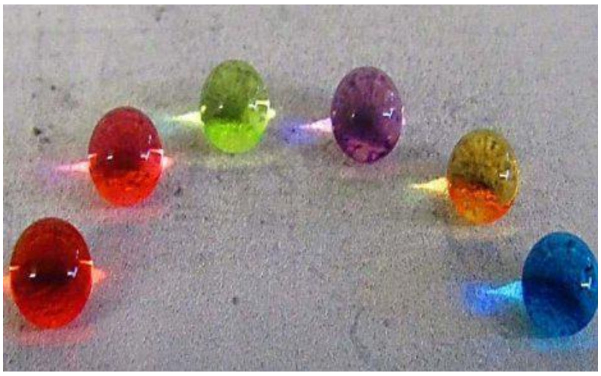


Is it possible to instantly diagnose diabetes, Ebola or some other disease, simply by watching how a droplet of blood moves on a surface?It is possible by a new research led by ArunKotaatColorado State University. They makes coatings that repel not just water, but virtually any liquid, including oils and acids- a property called Superomniphobicity.

They described their most recent innovation as “Lab on a Chip”. They made a simple and inexpensive device that can sort droplets of liquid based solely on the liquid’s varying surface tensions. They did it by making their device's surface tunable that is they can manipulate its surface chemistry to turn up or turn down how well it repels liquids.



The researchers patterned a surface with titanium dioxide "nanoflowers" by decorating a pristine thin film of titanium in a nanoscale pattern that looks like a field of flowers under a scanning electron microscope. Exploiting titanium dioxide's photo-catalytic properties, they slightly changed the surface chemistry on various spots on the device by shining UV light on it for set lengths of time.

This elegantly simple concept could form the basis for a host of applications, from biosensors for point-of-care diagnostic platforms to lab-on-chip systems that can quickly distinguish between droplets of different chemicals, or diseased and non-diseased blood.

The interesting fact is how and why some materials result in superomniphobicity, as well as perfecting the science behind superomniphobicsurfaces.The dream is to create superomniphobic surfaces that are mechanically durable.

Result: A flat film that can sort liquid droplets based on their surface tensions, when the device is placed at a slight incline.

References:https://www.sciencedaily.com/releases/2016/07/160719152217.htm

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The Maths behind Medical Science: Credit Where It's Due

Ms.Sucheta Jain
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As well as ultrasound scans, there are CAT scans, PET scans, MRI scans... The miracles of modern medicine are all around us, and we tend to take them for granted. We also ignore what goes into making them work. They are not just miracles of medicine, but of biology, genetics, chemistry, engineering, and computer science.
But something is missing from that list. You've guessed it: mathematics. Very little of today's technology can work without a lot of maths. Even less of it could have been invented or manufactured. Medical scanners are a case in point.

You shouldn't be made to pass a maths exam in order to be given an ultrasound scan, or to operate a scanner.But**let's give credit where it's due**. Although people don't need to know any maths to use a scanner, or to be given a scan, it's important that they should understand that there is maths going on behind the scenes. It's much less important for them to have any idea of what the maths is, or how it works: what counts is awareness that it is there. Otherwise society will fail to appreciate how vital maths really is, and we will all suffer the consequences.

Modern scanners don't work the way early X-ray machines did. Those were basically just cameras that used X-rays instead of light, and special film, to take a picture of your insides. But it was a view from a single direction, where only an expert could tell which bones and organs were in front or behind. Many of today's scanners produce three-dimensional images, which can be stored in a computer, so that graphics software can slice them up, or strip away flesh to reveal bare bones, or show just the lungs.

An ultrasound image of a four-month-old foetus - just one of the many fruits of modern mathematics.

No scan is just a simple image made the way a camera would.
Instead, scanners probe the body's internal organs with various kinds of signal - sound waves, x-rays, subatomic particles emitted by radioactive atoms. The internal organs change these signals in various ways - dense materials absorb some of the sound or the x-rays, soft tissues don't reflect them as well as hard ones, and so on. The images somehow have to be worked out from these subtle changes in the signals.
That's where the maths comes in. The signals have to be processed to extract the imaging information in a usable form. Some of the basic maths required was discovered 90 years ago, some has been developed since then, and some was invented recently by mathematicians and engineers trying to improve scanning technology.
So next time you watch your friend's unborn baby kicking away merrily, please pause for a brief moment, and mentally give a little bit of credit to the mathematicians who played their part in making this miracle possible.Then enjoy the pictures, like any normal human being.
http://www.telegraph.co.uk/news/science/7935124/The-maths-behind-medical-science-credit-where-its-due.html

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Does Caffeine Really Dehydrate You ?

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Caffeine — found in coffee, tea, soda and even chocolate — is the most widely consumed psychoactive substance on the planet. Used predominantly as a means to perk people up, the stimulant is legal and unregulated in most parts of the world. However, it's commonly thought that caffeine is responsible for some undesirable side effects, including dehydration.

The idea that caffeine can cause dehydration can be traced to a study performed in 1928 that noted increased urination in people who drank caffeinated beverages, and suggested that caffeine was a diuretic, according to Lawrence Armstrong, a professor in the Department of Kinesiology at the University of Connecticut and director of the Human Performance Laboratory. The idea spread, and caffeine's reputation as a dehydrating substance was solidified.

But science says it's a bit more complicated than that

"The truth of the matter is, a small increase in urine output has little to do with dehydrating the body," Armstrong told.

He added that any increase in fluid input will lead to an increase in urine output. "If you drink a liter of water, [urination] will increase," Armstrong said. "Doesn't mean you shouldn't drink water."

In 2005, Armstrong and a team of researchers set out to put the myth to rest. They controlled the diets of 59 healthy males for 11 days, supplementing their daily consumption with body-mass-appropriate doses of caffeine, administered twice a day via capsule. Throughout the study, the researchers employed 20 different hydration biomarkers, such as urine volume and fluid-electrolyte balance, to assess dehydration.

While previous studies had investigated the effects of caffeine over short periods of time, Armstrong's research was the first to evaluate caffeine consumption for a continuous period longer than 24 hours.

The study found that the evaluated hydration indicators, including urine volume, were similar for all of the treatment groups. This finding demonstrates that caffeine does not have a dehydrating effect when compared to the control group (participants who received a placebo and did not consume any caffeine). The scientists also found that a higher dose of caffeine was no more likely to dehydrate a person than smaller doses were.

According to a 2016 investigation conducted by the University of Washington's Center for Public Health Nutrition, coffee remains the most significant source of caffeine in American diets. Though it doesn't cause dehydration, the stimulant has its share of purported side effects, including rumors that it may stunt people's growth or cause cancer. However, scientific research so far has not supported the idea that caffeine is bad for you, either.

"The fact that we don't have hospital emergency rooms filled with patients]because they drank caffeinated beverages is clear evidence ... If there were negative health effects, they certainly would have been identified," Armstrong said.

It is possible to consume too much caffeine, but Armstrong said the lethal dose is about 10,000 milligrams in a day. To put that number into perspective, the Mayo Clinic reports that an 8-ounce cup of coffee contains about 95 milligrams of caffeine. So, in order to overdose, you'd have to drink more than 100 cups of coffee in a day.

In fact, some scientific studies show that coffee actually has a number of health benefits.

"There's a lot more in a coffee bean than caffeine," Armstrong said. "The highest antioxidant intake among adults in America comes from coffee."

Research suggests that ingredients in coffee can protect against liver cancer, prevent the development of type 2 diabetes, lower blood pressure, and even combat dementia and depression.

Concerns about excessive caffeine consumption, particularly in children and adolescents, as well as harmful interactions with other drugs such as alcohol, require further research. But as it stands, your daily cup of joe isn't going to dehydrate you, and it might just have some added health benefits while getting you through your morning.

Reference :-
http://www.livescience.com/55479-does-caffeine-cause-dehydration.html

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Discovery of Two New Baryon Particles at CERN

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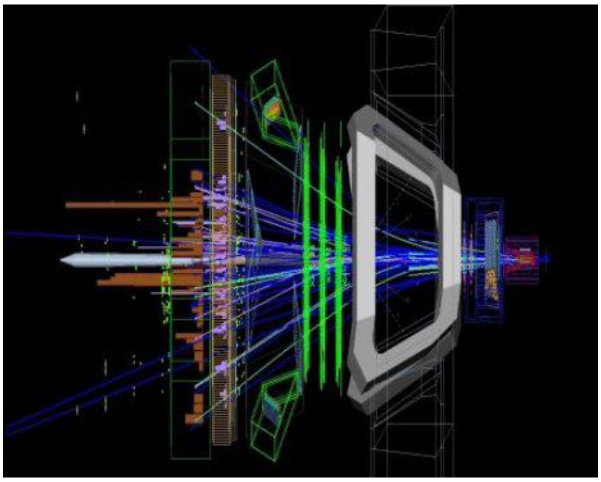
LHCB at CERN's Large Hadron Collider has announced the discovery of two new particles in the baryon family. The particles, known as the Xi_b$'^{-}$ and Xi_b^{*-}, were predicted to exist by the quark model but had never been seen before. A related particle, the Xi_b^{*0}, was found by the CMS experiment at CERN in 2012.

The new particles are baryons made from three quarks bound together by the strong force. The most familiar baryons are the protons and neutrons that make up most of the mass of the visible matter in the universe. The types of quarks are different, though: the new X_ib particles both contain one beauty (b), one strange (s), and one down (d) quark. Each of the quarks has an attribute called "spin". In the Xi_b$'^{-}$ state, the spins of the two lighter quarks point in the opposite direction to the b quark, whereas in the Xi_b^{*-} state they are aligned.



"Nature was kind and gave us two particles for the price of one," said Matthew Charles of the CNRS's LPNHE laboratory at Paris VI University. "The Xi_b$'^{-}$ is very close in mass to the sum of its decay products: if it had been just a little lighter, we wouldn't have seen it at all using the decay signature that we were looking for."

"This is a very exciting result. Thanks to LHCb's excellent hadron identification, which is unique among the LHC experiments, we were able to separate a very clean and strong signal from the background," said Steven Blusk from Syracuse University in New York. "It demonstrates once again the sensitivity and how precise the LHCb detector is."

As well as the masses of these particles, the research team studied their relative production rates, their widths – a measure of how unstable they are – and other details of their decays. The results match up with predictions based on the theory of Quantum Chromodynamics (QCD)

QCD is part of the Standard Model of particle physics, the theory that describes the fundamental particles of matter, how they interact and the forces between them.

Reference:https://home.cern/about/updates/2014/11/lhcb-observes-two-new-baryon-particles

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Why Charging Phones Overnight Is Bad

Dr. Neeraj Puri
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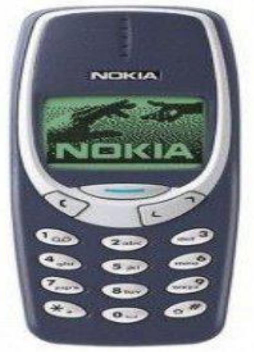
To know the answer to the question why charging phones overnight is bad, we need to a little about the personalities of a Lithium Ion or Lithium Polymer battery. These are the same exact types of batteries commonly found in your mobile phones. I've studied these batteries for years due to my love of gadgets and because of my hobby in radio control racing.

How to make the batteries last longer per charge? How to prolong their lifespan? How to prevent having batteries explode in my face? These are important questions to me and I've spent lots of time digging.

While the internet is a convenient tool, there are simply too many misconceptions about your smartphone batteries floating around on the internet. No thanks to the fact that Lithium Ion/Polymer batteries behave very differently from their predecessors, the Nickel metal hydride batteries that have graced the phones of yesterday years. If you have a Nokia 3310, the battery inside is a Nickel metal hydride (NiMH).

Because many people don't really know the differences between the older battery types, they ended up giving battery advice that really harm your Lithium Ion (Li-ion)/Polymer(LiPo) batteries (I shall collectively refer to these as 'Li').

Bad advice are plentiful. Charge your phone for 6 hours before using? Only charge your battery when it is close to empty? These are just some of the advice that were perfect for NiMH batteries but will cause your Li batteries to suffer a slow, horrible death.



Back to the topic at hand. Should you charge your phone overnight? To answer that, let's look at my handy summary of Li battery characteristics:

- Li batteries are afraid of heat. The higher the temperature, the faster it loses capacity over time.

- Li batteries are afraid of being empty. The emptier it is, the faster it loses capacity over time.

- Li batteries are afraid of being full. The fuller it is, the faster it loses capacity over time.

- Li batteries are afraid of being overcharged (charged more than full) or short circuited. If it gets charged too much, it gets bloated due to chemical reactions in the cell.

- Li batteries are afraid of being over-discharged (use more energy than the battery is willing to give). If it gets discharged too much, it gets bloated due to chemical reactions in the cell.
- Li batteries are afraid of being ruptured. If the internals are exposed to air, it catches fire and

burn.

- Li batteries keep the scores well. If you charge from 50% to 100% twice, that is considered one charge cycle, not 2.

  Expecting more? Nope, that's all you need to know.

  So overnight charging. Is it good or bad?

  Let's talk about safety first. Overnight charging is generally safe as long as your battery, charger and mobile phone are all from reputable manufacturers. Badly manufactured chargers and mobile phones may have overcharge protection circuit that fails, cause your battery to get over charged. When you battery gets overcharged, the internal cell undergoes a chemical reaction, and the battery start to bloat.

  If the bloat is too much, the battery ruptures, causing the internals to be exposed to air, resulting in fire and explosion.

  While this is still O.K. if you are around and can swiftly put out the fire or prevent the fire from spreading, leaving your smart phone to charge unattended isn't safe.

Source:-www.yahoo.com

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Peculiar Pattern Found In 'Random' Prime Numbers

Ms. Manjit Kaur
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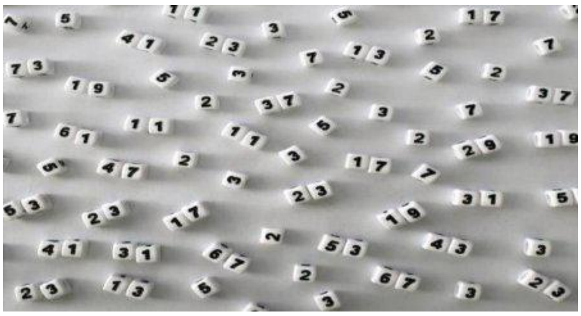
Two academics (Kannan Soundararajan and Robert Lemke Oliver of Stanford University in the US) have shocked themselves and the world of mathematics by discovering a pattern in prime numbers. Kannan Soundararajan is a leading mathematician who also shared the first SASTRA Ramanujan prize with Manjul Bhargava. This is a prize given for outstanding work done by mathematicians under 32 years of age.



Primes - numbers greater than 1 that are divisible only by themselves and 1 – are considered the ‘building blocks’ of mathematics, because every number is either a prime or can be built by multiplying primes together .Their properties have baffled number theorists for centuries, but mathematicians have usually felt safe working on the assumption they could treat primes as if they occur randomly.

Now, however, Kannan Soundararajan and Robert Lemke Oliver of Stanford University in the US have discovered that when it comes to the last digit of prime numbers, there is a kind of pattern.Apart from 2 and 5, all prime numbers have to end in 1, 3, 7 or 9 so that they can’t be divided by 2 or 5.

So if the numbers occurred randomly as expected, it wouldn’t matter what the last digit of the previous prime was. Each of the four possibilities – 1, 3, 7, or 9 – should have an equal 25 percent chance of appearingat the end of the next prime number.

But after devising a computer programme to search for the first 400 billion primes, the two mathematicians found prime numbers tend to avoid having the same last digit as their immediate predecessor. In the words of Dr Lemke Oliver “really hate to repeat themselves.”

A prime ending in 1 was followed by a prime ending in 1 only 18.5 per cent of the time, significantly less often than the expected 25 per cent. And, the pair found, primes ending in 3 tended be followed by primes ending in 9 more often than in 1 or 7.

The pattern - already being referred to as ‘the conspiracy among primes’ - has left mathematicians amazed that it could have remained undiscovered for so long.

Reference:https://www.newscientist.com/article/2080613-mathematicians-shocked-to-find-pattern-in-random-prime-numbers/

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Some basic facts about Chemistry

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Chemistry is the study of matter and energy and the interactions between them. Here are some interesting facts about chemistry.

Chemistry traces its roots back to the ancient study of alchemy. Chemistry and alchemy are separate now, though alchemy still is practiced today.

All matter is made up of the chemical elements, which are distinguished from each other by the numbers of protons they possess.

The chemical elements are organized in order of increasing atomic number into the periodic table. The first element in the periodic table is hydrogen.

Each element in the periodic table has a one or two letter symbol. The only letter in the English alphabet not used on the periodic table is J. The letter q only appears in the symbol for the placeholder name for element 114, ununquadium, which has the symbol Uuq.

At room temperature, there are only two liquid elements. These are bromine and mercury.TheIUPAC name for water, H_2O, is Dihydrogen monoxide.

Most elements are metals and most metals are silver-coloured or grey. The only non-silver metals are gold and copper.

The discoverer of an element may give it a name. There are elements named for people (Mendelevium, Einsteinium), places (Californium, Americium) and other things.

Although you may consider gold to be rare, there is enough gold in the Earth's crust to cover the land surface of the planet knee-deep.

References:https://chemistry.about.com/od/generalchemistry/a/10-Basic-Chemistry-Facts.htm

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Intresting Facts related to chemistry

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- The only elements that are liquid at room temperaturearebromine and mercury. However, you can melt gallium by holding a lump in the warmth of your hand.
- Unlike many substances, water expands as it freezes. An ice cube takes up about 9% more volume than the water used to make it.
- If you pour a handful of salt into a full glass of water, the water level will actually go down rather than overflowing the glass.
- There is about 1/2 lb or 250 g of salt (NaCl) in the average adult human body.
- A pure element can take many forms. For example, diamond and graphite both are forms of pure carbon.
- The chemical name for water (H_2O) is dihydrogen monoxide.
- The only letter that doesn't appear on the periodic table is J.
- Lightning strikes produce O_3, which is ozone, and strengthen the ozone layer of the atmosphere.
- The only two non-silvery metals are gold and copper.
- Although oxygen gas is colorless, the liquid and solid forms of oxygen are blue.
- The human body contains enough carbon to provide 'lead' (which is really graphite) for about 9,000 pencils.
- Hydrogen is the most abundant element in the universe, while oxygen is the most abundant element in the earth's atmosphere, crust, and oceans (about 49.5%).
- The rarest naturally-occurring element in the earth's crust may be astatine. The entire crust appears to contain about 28 g of the element.
- Hydrofluoric acid is so corrosive that it will dissolve glass. Although it is

is considered to be a 'weak acid'.

- One bucket full of water contains more atoms than there are bucketfuls of water in the Atlantic ocean.
- Approximately 20% of the oxygen in the atmosphere was produced by the Amazon rainforest.
- Helium balloons float because helium is lighter than air.
- Bee stings are acidic while wasp stings are alkaline.
- Liquid nitrogen boils at 77 Kelvin (−196 °C, −321 °F).
- Around 1% of the sun's mass is oxygen.
- Chemical reactions occur all the time, including through everyday activities such as cooking
- Hot peppers get their heat from a molecule called capsaicin. While the molecule acts as an irritant to mammals, including humans, birds lack the receptor responsible for the effect and are immune to the burning sensation from exposure.
- Dry ice is the solid form of carbon dioxide, CO_2.
- Liquid air has a bluish tint, similar to water.

Reference:-

http://chemistry.about.com/od/chemistryforkids/a/Fun-And-Interesting-Chemistry-Facts.htm

A Digital monthly Newsletter of Faculty of Natural SciencesGNA University, Phagwara

Maths (Ratio), Music (Production Of Sound) and Science

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Each glass makes a sound when you tap its side with a spoon (to avoid breakage, use a plastic spoon, not a wooden or a metal one) because the spoon causes a vibrating sound wave. The sound wave travels through the water in the glass and eventually reaches your ear. Each glass makes a different sound because the sound waves travel through the water at different speeds, causing vibrations at different frequencies. (Frequency refers to the number of times a sound wave vibrates per second).

The glasses with the most water produce the lowest sounds because the sound waves travel slowest (causing the lowest frequency vibrations) through all that water. The glasses with the least amount of water produce the highest sounds because sound waves travel fastest (causing the highest frequency vibrations). In fact, when the sound waves of one note vibrate at twice the frequency of another, the two notes are exactly one octave apart.