UBIQUITOUS

The Physics e-newsletter

Jan-May 2020 issue

Presented by
The Department of Physics
Kalindi College
East Patel Nagar, University of Delhi

MESSAGE

By the Teacher
(Dr. Punita Verma, Associate professor, Kalindi College)-

"Science is simply the word we use to describe a method of organizing our curiosity" - said Tim Minchin, and exactly that is reflected in the E-magazine that you are about to browse through. When students lead a project, it has the authenticity of passion and genuineness of expression. The articles written or reproduced here, are a reflection of their careful selection and the growth mindset. If educators succeed in igniting the curiosity, sparking creativity and chiselling the productivity of their students, then the future of the nation is predictable. This issue of Science newsletter "Ubiquitous" is special as it has been prepared by 2017-2020 batch exclusively.

I congratulate the enthusiastic team of writers, editors and creative designers who have brought the rainbow of scientific temperament strung in words, for you.

By the Chief Editor
(Sejal Arora,, B.Sc. (H) Physics, 2017-2020 batch, Kalindi College) –

The first thing anyone at my place would say is a very common word for expressing gratitude, "Thank you"! This is a fair fit for everyday situations, but in my case, I find myself struggling to find an expression that can befit the deep sense of satisfaction and delight that I've experienced after completing this very special piece of work on our beloved physics. So, I decided to go for yet another not-so-common standard to fulfill my purpose; a 'hap'. I would call 1 hap as the intensity of happiness we feel each time we learn something new in the intriguing world of physics and how subtly it keeps our universe running. So out of the 25 hap level of happiness I can feel right now, I would like to share 6 haps of them with our principal, with whose kind support such an activity could be carried out in the first place. The next 6 are for my teacher-cum-mentor, Dr. Punita Verma, who deemed me capa ble of bringing out Ubiquitous as the first independent newsletter of the physics department of our college. Of course, the next two shares are for those who contributed their enriching ideas for this purpose, and our valuable readers who are the real beneficiaries and our source of motivation. I'll keep the remaining 1 hap for myself.

If Science is the King of all knowledge, then Physics is the Heart that keeps him alive. It is the study of nature, and indirectly the study of the divine who created nature. To fathom the depths of science is to realize this latent divinity. As Einstein said, "The more I study Science, the more I believe in God". Ubiquitous is but one drop of that divine ocean. So I wish my fellow learners to keep learning science with all your heart, and flow wherever it takes you. Keep rising.

AN EXCURSION THROUGH TIME

Time travel is something that we all have heard of in many science fiction movies or TV shows or novels. Most of us even know what it means, or do we? I'm sure everyone would love a journey to the past, I mean who wouldn't want to say "Hi!" to their past selves or to go into the future and see all the flying cars, virtual meetings through holograms and robots everywhere? You might think of creating a time machine, like Back To The Future or The Time Machine, or a quantum tunnel from Avengers Endgame that could allow you to travel through time.

Now, leaving all the pop culture references behind us let's ask ourselves, Can we really travel through time? Is it possible to move forward or back in time? Can we go 1000 years into the future and see our great great great great grand daughter/son? The answers to all these questions have been agonizing the physicists for many years. Many scientists are working hard in envisioning the possibility of time travel.

What is Time?

To understand time travel, we must first know what exactly time is! Is time linear or cyclic? Is it Endless or Finite? Is it even real or not? In classical physics, time is the part of fundamental structure of the universe– a dimension independent of events in space. Before Einstein's Theory Of Relativity, time was presumed to be absolute and was considered to be same everywhere in the universe. But Special and General Relativity changed our perspective of time. The special theory tells us that the clock in a reference frame moving with speed comparable to the speed of light moves slower than the one kept in the reference frame which is not moving at all, in relativity we call it Time Dilation which explains the famous Twin Paradox. From general relativity we know that time duration between two successive events is also affected by gravity as viewed from another frame.

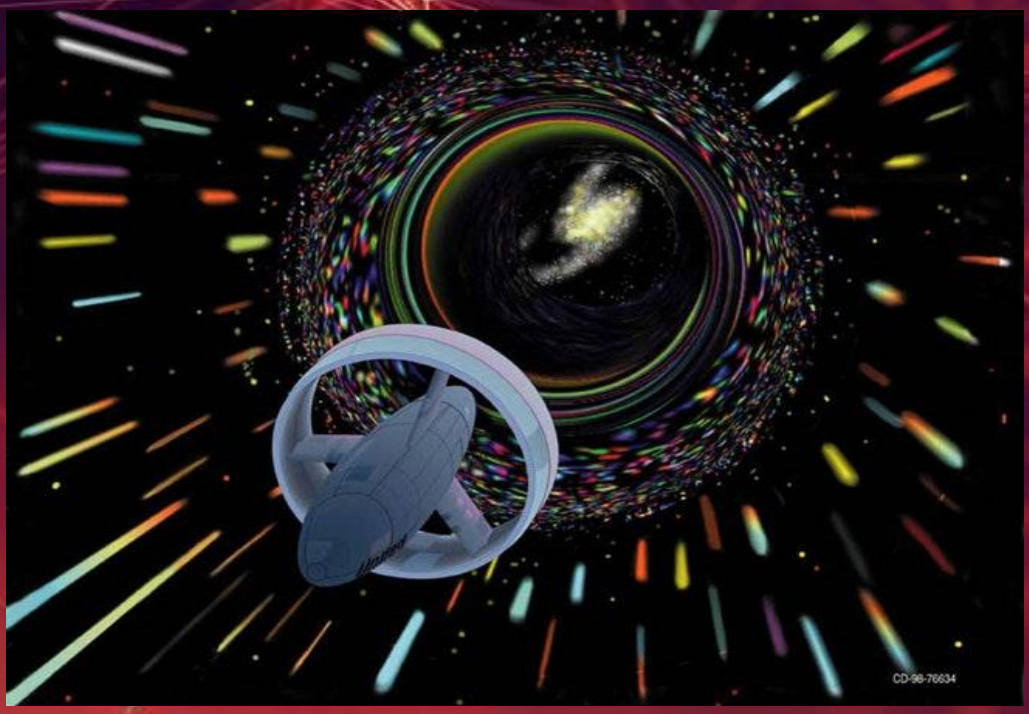
So we can say that time and space are "not absolute but relative". This statement can also be explained using the principle of invariance in relativity, in which we consider the space-time interval $s^2 = x^2 + y^2 + z^2 - c^2t^2$, where x, y and z are spacial components, t is the time component and c is the speed of light. This component is invariant under Lorentz

transformation which is a tool used for transformation of coordinates in two frames S (at rest) and S' (moving with relativistic speed). The space and time coordinates cannot remain invariant when taken independently. The invariance of this component shows that space and time are related.

Time appears to have direction – the past, fixed and immutable, and the future which lies ahead and is not necessarily fixed. The arrow of time is a concept positing the "one-way direction" of time. Albert Einstein once said, ``*The distinction between past, present, and future is only a stubbornly persistent illusion."*

Moving through Time

Travel into the past is probably impossible because of some practically unachievable conditions, but travelling to the future is a different story. Traveling to the future is a relatively easy process, at least when compared to going backwards in time. But beware, before we set off to see our grandchildren and great-grandchildren, we should realize that getting back to our own time is not an easy affair and may not be possible at all.



We all are swept along in the current of time, form the past into the future. But, as with a river, the current flows at different speeds in different places. Science as we know it allows for several methods to take the fast-track into the future. According to Special relativity, when you travel with speeds close to the speed of light, time slows down for you relative to

the outside world, a phenomenon known as *time dilation*. The highest speeds achieved through any human technology are probably of the protons whizzing around the Large Hadron Collider at 99.9999991% of the speed of light. Using special relativity we can calculate one second for the proton is equivalent to 27,777,778 seconds, or about 11 *months*, for us. So, if want to go to the future, this is the best way, only if you don't have any plans of coming back.

Another method of time travel was also given by Einstein in his General Theory of relativity, according to which the stronger the gravity you feel, the slower the time moves.

To travel to the far future, all we need is a region of extremely strong gravity, such as a black hole. The closer you get to the event horizon, the slower the time moves – but it's risky business, cross the boundary and you can never escape. And, the effect is not that strong so it's probably not worth the trip. Assuming you had the technology to travel the vast distances to reach a black hole (the nearest is about 3,000 light years away), the time dilation through travelling would be far greater than any time dilation through orbiting the black hole itself (The situation that was described in the movie *Interstellar*, where one hour on a planet near a black hole is the equivalent of several years back on Earth, is so extreme as to be impossible in our Universe, according to Kip Thorne, the movie's scientific advisor.).

If I have seen further it is by standing on the shoulders of Giants. We must all stand on our forefathers to better ourselves and the world.

General relativity also allows for the possibility for shortcuts through spacetime, known as wormholes, which might be able to bridge distances of a billion light years or more, or different points in time. Wormhole geometries are inherently unstable. The only material that can be used to stabilize them against pinching off is material having negative energy density, at least in some reference frame. No classical matter can do this, but it is possible that quantum fluctuations in various fields might be able to. Stephen

Hawking conjectured that while wormholes might be created, they cannot be used for time travel; even with exotic matter stabilizing the wormhole against its own instabilities, he argued, inserting a particle into it will destabilize it quickly enough to prevent its use something called as the Chronology Protection Conjecture. Many physicists, including Stephen Hawking, believe wormholes are constantly popping in and out of existence at the quantum scale, far smaller than atoms. The trick would be to capture one, and inflate it to human scales – a feat that would require a huge amount of energy, but which might just be possible, in theory. Wormholes could allow travelling back in time however the equations would be physically difficult to achieve, one way is to travel faster than light (which seems to be physically impossible).

Can past be changed?

Assuming you can go into the past, what then? Can you change your own past? Or will you create multiple realities? Or is it something entirely new? Well, American Physicist Michio Kaku explains time as river, the river is flowing with different speeds in different points of space.

The river of time may have whirlpools and it may fork into two separate rivers, this also explains all the paradoxes of time travel. Like if we take the example of Grandfather paradox in which you go back in time and kill your grandfather before he had any children. We can try to solve it in many ways, hypothetically of course. The first solution to this famous paradox could be, when you go back in time to kill your grandfather, you're not going back to your own history, but a copy of your history, and everything you do in that version of your history will affect the alternate future of that universe, not your own. In

which case all your atoms will be scanned and destroyed in the process, because there's no cloning allowed in quantum mechanics. Then all that information about you will be teleported to the new location, where a bunch of new atoms will be used to build a whole new you, complete with memories, personality quirks and everything else. Another answer could be that if you go back in time and kill your grandfather, you can't simply exist, hence your grandfather can't be killed. Therefore, there are two realities will be happening in parallel. .If you apply this kind of thinking to the grandfather paradox, you get something called a *closed time loop*, where your grandfather is simultaneously dead and alive and so are you as a result of that. Mind=Blown!!!

To this date, all of this is only a theoretical concept. We are limited by the technology of our time. Even though we're making an incredible progress in testing theories through experiments, we're still way behind in our attempt to understand this universe. But the fundamental elements of the universe are governed by probability. So, who knows what will happen in the future? Maybe we'll be able to create a stable wormhole and pass some particles through it. Or maybe someone will find an entirely new way to travel across time. We can only give our best in formulating new theories and testing them. In time, we might find some significant results.

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Natasha

B.Sc. (Hons.) Physics, 3rd Year

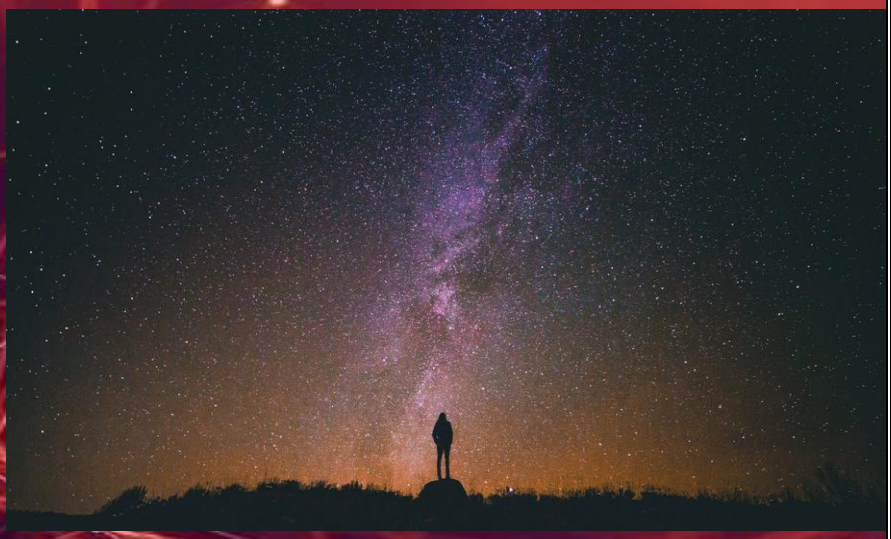
(2017-2020 batch)

FINDING THE EDGE OF THE UNIVERSE

Imagine standing at the edge of the universe and shooting an arrow outward. If the arrow keeps going, then clearly, the universe extends beyond what you thought was the edge. But if the arrow doesn't keep going say it hits a wall then that wall must lie beyond what you thought was the edge of the universe. Now if you stand on that wall and shoot another arrow, there are only the same two possible outcomes it either flies forever out into space, or it hits some boundary where you can stand and shoot yet another arrow. Either way, the universe is unbounded.

-LUCRETIUS

CURIOSITY IS THE DRIVING FORCE



Watching the stars on a clear night sky has fascinated me ever since my childhood days. All the stars grouped into beautiful constellations (like Orion, Cassiopeia, Auriga, Draco, Zodiac constellations, etc.), star clusters (Pleiades, Coma Berencies, Double cluster,etc.),Nebulae(Orion nebula), the planets our solar system(Mars, Venus, Jupiter, Saturn), neighboring galaxies(Andromeda, Small and Large Magellanic Clouds) and our own Milky Way which can be seen with the naked eye(believe me, provided you have the real dark, pollution free, moonless sky!) are bound to set our minds on a different note and we start asking these childlike questions: How this universe was created?, Why is it the way it is? Why are we here? How will this universe end (if ever it will!)? If you have never experienced this state of

mind, just give yourself a chance today. Go out today and look up to the heavens and you will see the Almighty's marvelous creations.Now, you must be thinking I am getting a bit too philosophical. Well, I cannot help it. It all actually starts with this. It all starts where your imagination begins, when your visualizing power sets in and you start appreciating and admiring the nature in all its beauty. That's my way of defining the term "Creativity". It's not just another word, it's the very word that defines your thinking, your perspective of looking into things and forming an understanding.

Great physicists of all time like Michael Faraday, James Clerk Maxwell, P.A.M Dirac, Werner Heisenberg, Albert Einstein, Edwin Hubble, Allan Sandage, Carl Sagan, you name it and you will know that each one of them have their own story of how they were intrigued by the nature and when I say nature, I mean starting from the scale of smallest possible element known to us, to the massive size of this universe. But these physicists are just a few to be named, the list goes on and on. The important question to address here is, "Did they all perceive the nature in the same way?" the answer to which we all are well familiar with. While Michael Faraday and James Clerk Maxwell are known for their work in the field of electromagnetism, Isaac Newton is known for his basic laws of classical physics, while Albert Einstein is considered the father of modern physics, Max Planck is known for his pioneering work in the field of quantum physics, and while Marie Curie did ground-breaking research in the field of radioactivity, it was Edwin Hubble who observed that our universe is expanding. Though, this is just a glimpse of a much bigger picture, but one thing which comes naturally is that each one tried to understand the nature in their own way. But what made them do so??

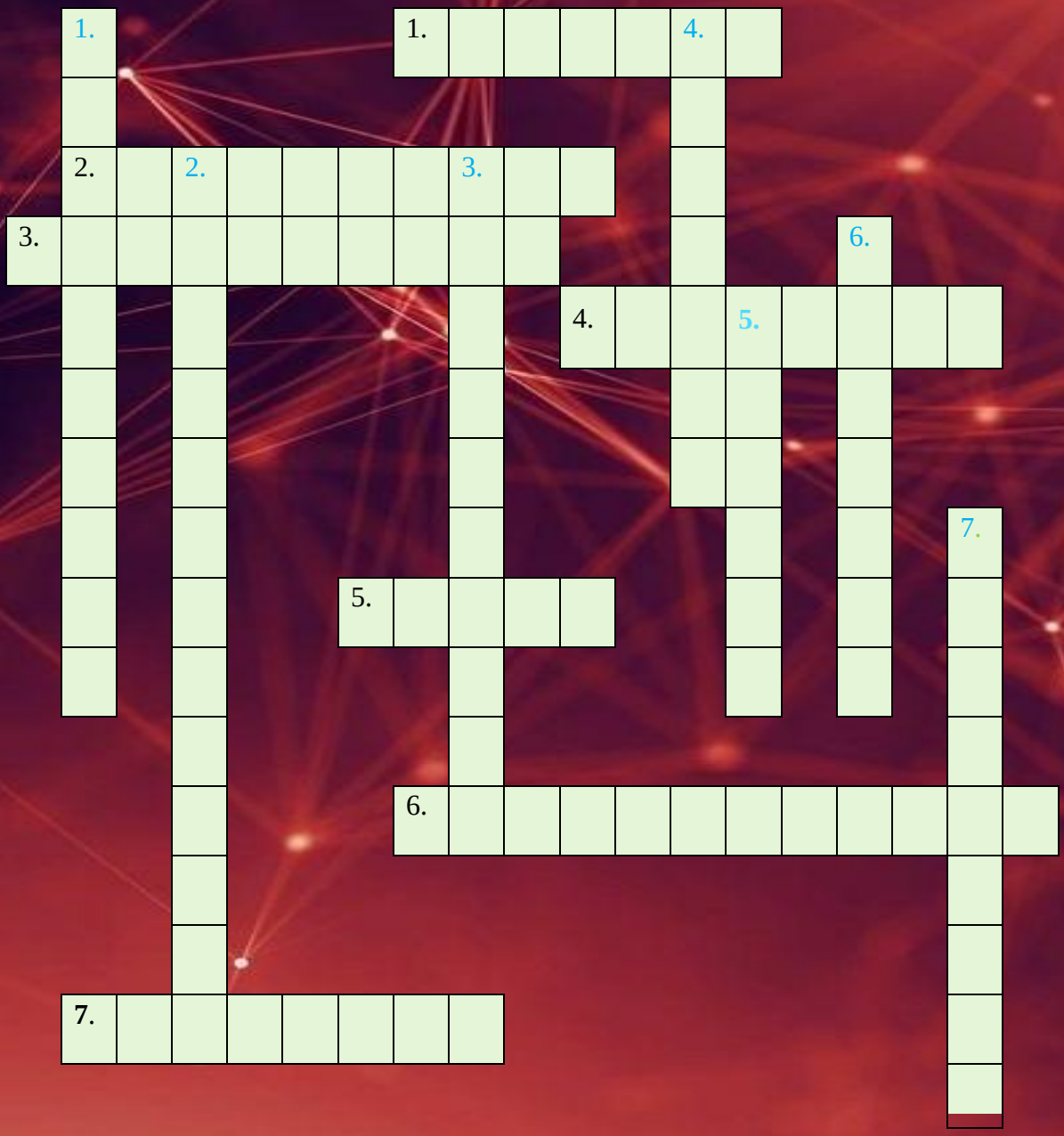
Our nature is very mysterious and the very beauty of it is enough to captivate us and motivate us to want to know it more in order to gain a deeper insight into it. It seems as if the nature is calling us to unravel its mysteries and the reason it influences us is that we humans are created with this feeling named "Curiosity" which is the only driving force compelling us to venture into the unknown.

There surely is a physicist hidden in each and every one of us!

Nivedita Chakraborty
B.Sc. (Hons.) Physics-III Year
(2017-2020 batch)

TICKLE YOUR BRAIN

CAUTION: DON'T TRY THE PUZZLE WITHOUT AN EXPERT'S GUIDANCE, THE PUBLISHER DOESN'T HOLD RESPONSIBILITY FOR ANY DAMAGE DONE TO THE SELF-ESTEEM, WHATSOEVER



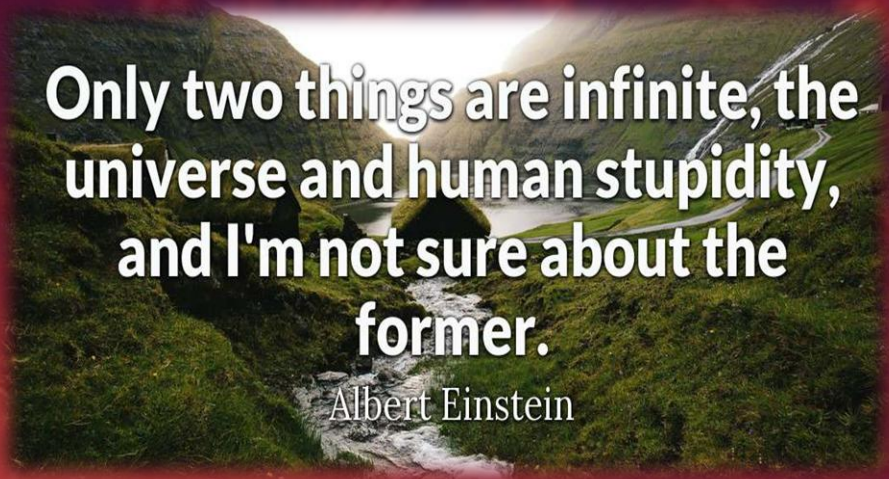
TOP TO BOTTOM

1. Function, yet not a function
2. Einstein's year of miracles (in words)
3. Characteristic value in Quantum Mechanics
4. A fundamental physical quantity
5. The standard used for defining 1 second
6. Borne by Vikram
7. Honey has it more than water

LEFT TO RIGHT

1. "Always false" in Boolean Algebra
2. The woman to win Nobel twice
3. 0 only at 0 in thermodynamics
4. Signature of an element
5. Emitted by an atom
6. Popular carnot engine
7. First scientist to win a Nobel prize in Physics

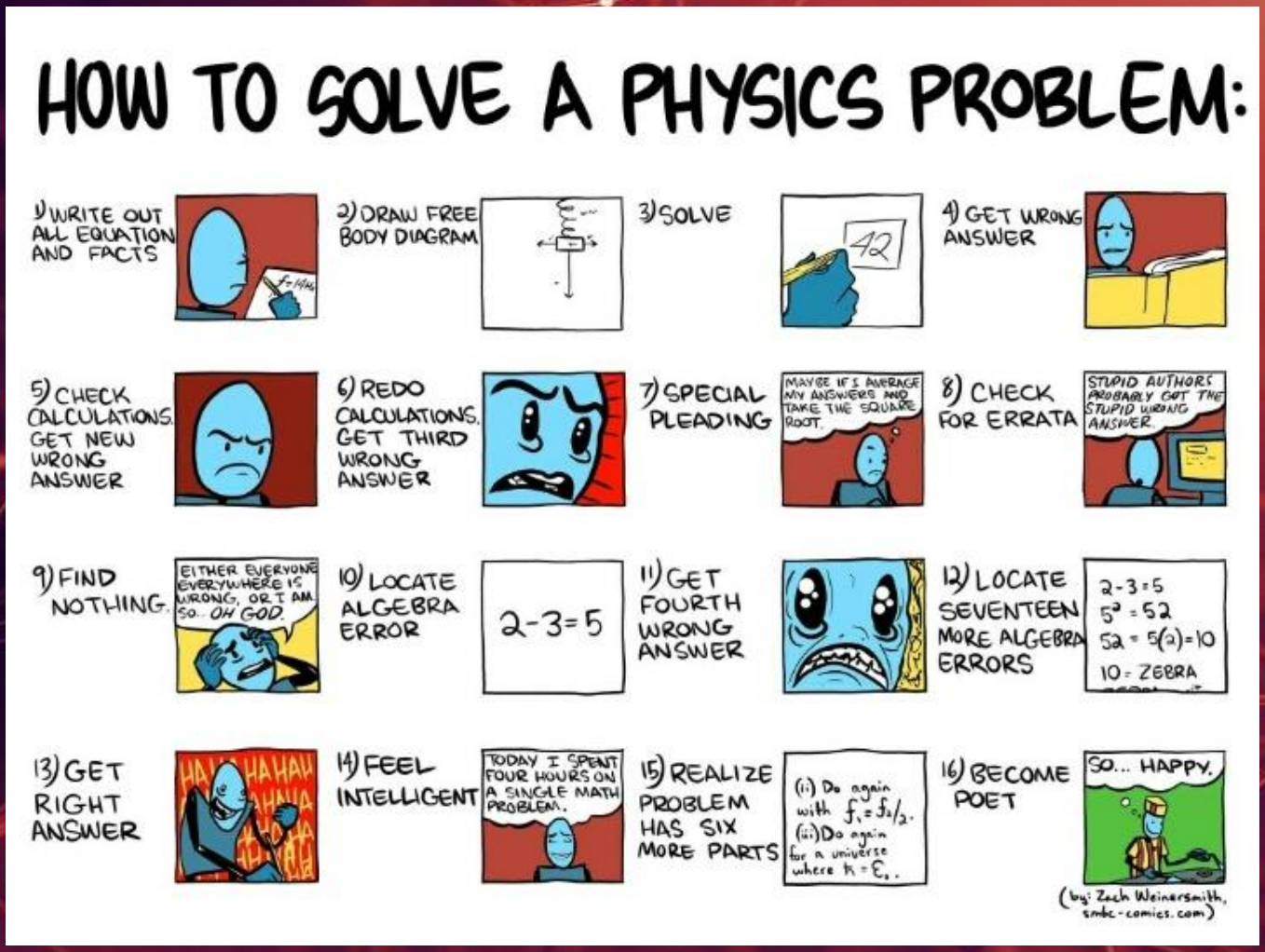
Sejal Arora
B.Sc. (H) Physics, 3rd year
(2017-2020 batch)



(It won't be disclosed that answers are in the end)

STRESS BUSTERS

(for those who overlooked the crossword warning)



When someone says nothing can be more complicated than love...

I throw my physics textbook on their face.

You enter the high school lab and see an experiment. How will you know which class is it?

.

.

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If it's green and wiggles, it's Biology

If it stinks, it's Chemistry

If it doesn't work, it's Physics!!

HEAVY POURING WREAKS HAVOC IN THE NATIONAL CAPITAL

(Staff correspondent, India Today)

New Delhi, 5 July 2019: The capital has been witnessing incessant rains for the past 5 days and is in a situation of utter chaos. The roads are perilously slippery and jammed, people are hooked to their houses and all inter-city communication is hampered, as the railway and airlines face cancellation due to flood-like conditions prevailing in the state. Sunny days are nowhere in sight.
The metropolitan has come to a standstill and temples are swamped with devotees praying for protection and mercy.

Now take a look at how a physicist would put it.....

Equilibrium has been disturbed in the capital due to a continuous function of precipitation freely falling at a uniform acceleration of 9.8 m/s2, for a time period of 5 days. The entropy of the city has thereby increased. The coefficient of friction of the graphite planes has gone down to 0.25 and the probability of inelastic collisions has doubled, the product of the two remaining constant. Radiowave exposure through Silicon based-devices has risen to dangerous levels since the net work done by the steam engines is 0. Fluid density in the neighbouring water bodies has surged and visible radiation from the sun has been strongly attenuated.
This has resulted in a stationary state of all the particles enclosed in the capital, whose centre of mass has been observed to shift towards the base station for communication with an extra-terrestrial power believed to be the initiator of the Big Bang.

Sejal Arora
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(2017-2020 batch)

Nothing in life is to be feared, it is only to be understood. Now is the time to understand more, so that we may fear less.
— Marie Curie

Marie Skłodowska Curie, born Maria Salomea Skłodowska, was a Polish and naturalized-French physicist and chemist who conducted pioneering research on radioactivity. Nominated for membership of the French Academy of Science, she was defeated by one vote because she was a woman!

FIRST IMAGE OF A BLACK HOLE

A region of space-time exhibiting gravitational acceleration so strong that nothing (no particles or even electromagnetic radiations such as light) can escape from it. Sufficiently compact mass can deform space-time to form a black hole. It is impossible to produce an image of a black hole since no light can escape .A team of international astronomers and computer scientists worked for this and improved upon an existing radio astronomy technique for high resolution imaging to detect the silhouette of a black hole.

Silhouette is an outline of something visible in restricted light against a brighter background. To get an image of a black hole, scientists adopted a technique that allows for the imaging of far-away objects known as Very Long Baseline Interferometry or VLBI, works by creating an array of smaller telescopes that can be synchronized to focus on the same objects at the same time and acts as a giant virtual telescope (the larger the aperture of telescope, the higher its resolution). The aperture of giant virtual telescope such as Event Horizon Telescope is equal to the diameter of Earth , by creating an array of smaller telescope and the farthest telescope stations-at the south pole and in Spain.

The Event Horizon Telescope team decided the two targets, Sagittarius A and M87 . The black hole Sagittarius A is at the center of our Milky Way galaxy and the super massive black hole M87 is located at the center of the gargantuan elliptical galaxy Messier 87, or M87(Substantially more massive than Sagittarius A). Each telescope had to be highly synchronized with the others to within a fraction of a millimeter using an atomic clock locked onto a GPS time standard. This degree of precision makes the EHT capable of resolving objects about 4,000 times better than the Hubble Space Telescope. As each telescope acquired data from the target black hole, the digitized data and time stamp were recorded on computer disk media. And the recorded data, around 5 petabytes, transported to a central location. Data from all the sites were synchronized using the time stamps and combined to create a composite set of images-silhouette of M87.

Reference: www.jpl.nasa.gov

Deepika Sharma
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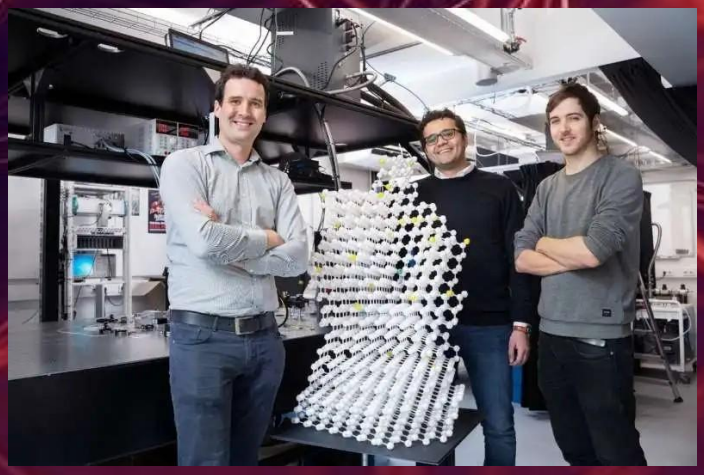
RESEARCHERS REPORT MRI ON THE ATOMIC SCALE

Researchers at QuTech, a collaboration of TU Delft and TNO, have developed a new magnetic quantum sensing technology that can image samples with atomic-scale resolution. It opens the door towards imaging individual molecules, like proteins and other complex systems, atom by atom.

Magnetic resonance imaging (MRI) and nuclear magnetic resonance (NMR) are powerful and widely-used methods in material science, biology, chemistry and medicine. Atomic nuclei behave like little magnets that generate tiny magnetic fields, which can be detected using antennas.

Magnetic imaging is non-invasive, can distinguish different types of atoms, and works under a wide range of conditions, including at room temperature. But current methods are limited to averaging over large volumes with large amounts of atoms, and imaging individual molecules or nanoscale structures is not possible.



QUANTUM SENSORS

"Our work is based on the nitrogen vacancy (NV) center," said first author Mohamed Abobeih. "This NV center occurs naturally in diamond: two carbon atoms are replaced by a single nitrogen atom. The center traps a single electron spin that can function as an atomic-sized sensor. By precisely manipulating this electron we can selectively pick up the tiny magnetic fields created by nuclei in the vicinity."

"At QuTech we generally use these NV centers as quantum bits, the building blocks for future quantum computers and the quantum internet. But the same properties that make NV centers good quantum bits, also make them good quantum sensors," said Tim Taminiau, lead investigator.

3-D IMAGING

Taminiau explained that his team built on previous research observing well-isolated nuclear spins. "These earlier studies indicated that the NV center is sensitive enough to resolve the tiny signals of individual nuclei. But for imaging complex samples such as molecules, just detecting nuclear spins is not enough," explained Taminiau. "You need to precisely determine the position of each spin in the sample, and that is what we set out to do." "We developed a method to obtain the 3-D structure of complex spin systems," said co-author Joe Randall. "Each nuclear spin feels the magnetic field from all the other nuclear spins. These interactions depend on the precise positions of the atoms and therefore encode the spatial structure. For example, two atoms that are closer to each other tend to interact more strongly. We developed methods to precisely measure these interactions and to transform them into a complete 3-D image with atomic resolution."

Imagination is more important than knowledge. Knowledge is limited. Imagination encircles the world.
-Albert Einstein

ATOMIC-SCALE RESOLUTION

To test their method, the researchers applied it to a cluster of 27 carbon-13 atoms in a highly pure diamond. This cluster of spins provides a model system for a molecule. After measuring more than 150 interactions between the nuclei and running an intense numerical reconstruction algorithm, the complete 3-D structure was obtained with a spatial precision much smaller than the size of an atom.

SENSING OUTSIDE THE DIAMOND

The next step is to detect samples outside of the diamond by bringing NV centers close to the surface. The ultimate goal is to be able to image individual molecules, such as proteins, and single quantum devices with atomic resolution.

Reference: https://phys.org/news/2019-12-mri-atomic-scale.html

Jyoti Dabla
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(2017-2020 batch)

Atom

Hello everyone, Atom is my name
Because of me Democritus got fame

You can't see me by your naked eyes
Because the very-very small is my size

In the centre of me, there is a nucleus
Because of two frnd, inside it there is too rush

Those friends are Neutrons and protons
And they are surrounded by the electrons

Electrons have -ve and protons have +ve charge
And compared to electron, Proton is very large

+ve and -ve attract ,we all know this fact
And that's why Proton and electron tend to interact

Neutron is neutral, you can also call it cheap
Please Read books if you wanna know in brief

Tamanna
Physics (hons) 3rd year

QUESTIONS TO PONDERRR.....

1) Is there indeed any colour in the so-called 'visible' light or they're mere waves of some arbitrary frequency, trying to deceive us???

2) How would the universe be like if sound could travel through vacuum???

3) Are there more cells in our body or more atoms in a cell???

4) How would it be like in a parallel universe, where only anti-gravity exists???

5) What would happen if air comprised 100% Oxygen???

6) Imagine God tells you He's decided to add another 2 hours to a normal 24-hr day. How would you react???

7) If you were given a chance to design a law of Physics at will, what would it be???

8) Shut your eyes and enter into the alien world. You are one of them now and want to vanquish the Earth without showing pity for any creature whatsoever. How would you begin???
(Remember, you are only allowed to use Physics!!)

9) How would the next Apocalypse occur (if it would)???
Beware: If you get the answer right, God will probably change the plan!

10) If Einstein was asked, " What's Up?", what'd he have replied???

HAVE A NICE TIME PONDERING :D

Sejal Arora
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(2017-2020 batch)

THE LINGERING CONUNDRUMS

In 1900, the British physicist Lord Kelvin is said to have pronounced: "There is nothing new to be discovered in physics now. All that remains is more and more precise measurement." Within three decades, quantum mechanics and Einstein's theory of relativity had revolutionized the field. Today, no physicist would dare assert that our physical knowledge of the universe is near completion.

If you've ever watched an episode of Star Trek or The Big Bang Theory, then you know that physics can be made accessible to the masses in a fun way. Our favorite sci-fi and comedy writers may not get every detail right, but they do spark our interest in the weirder aspects of scientific theories.

You may even want to explore these topics further on your own. After all, there are million dollar prizes waiting for the people who solve some cosmic puzzles. After all your Nobel Prize is at stake!

Where Do Ultra-High-Energy Cosmic Rays Come From?

Our atmosphere is constantly being hit by particles from outer space with high energies. These are called "cosmic rays." Although they don't pose much harm to humans, they have fascinated physicists. Observing cosmic rays has taught us a lot about astrophysics and particle physics. But there are some—the ones with the most energy—that are mysterious to this day.

In 1962, at the Volcano Ranch experiment, Dr John D. Linsley and Livio Scarsi saw something incredible: an ultra-high-energy cosmic ray with an energy of more than 16 joules. To give you some perspective, one joule is roughly the energy it takes to lift an apple from the floor onto a table. All of that energy is concentrated, though, in a particle a hundred million billion billion times smaller than an apple. That means that it's traveling very close to the speed of light!

Physicists don't yet know how these particles get this incredible amount of energy. Some theories include the idea that they might come from supernovae, when stars explode at the end of their lives. The particles may also be accelerated in the disks of collapsing matter that form around black holes.

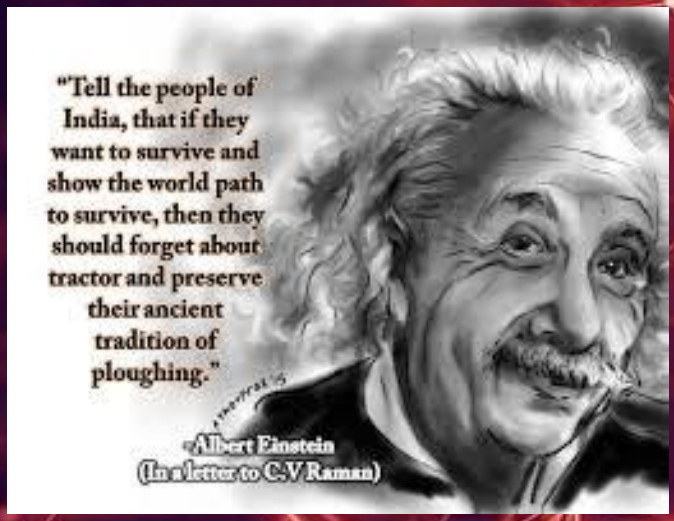
Can We Find Dark Energy And Dark Matter?

It's an amazing fact: Only around 5 percent of the universe consists of the matter that we can see. Physicists noticed some decades ago that the stars on the outer edges of galaxies were orbiting around the center of those galaxies faster than predicted.

To explain this, the scientists suggested that there might be some unseen "dark" matter in those galaxies that caused the stars to rotate more quickly. After this, observations of the expanding universe led physicists to conclude that there must be a lot more dark matter out there—five times as much as the matter we can see.

Alongside this, we know that the expansion of the universe is actually accelerating. This is strange because we'd expect the gravitational pull of matter—both "light" and "dark"—to slow down the expansion of the universe. Combine this with the fact that the universe is flat—space-time, overall, is not curved—and cosmologists need an explanation for something that balances the gravitational attraction of matter. "Dark energy" is the solution. Most of the energy in the universe can't be locked up in matter, but instead, it's driving the expansion of the universe. Physicists believe that at least 70 percent of the universe's energy is in the form of dark energy.

Yet to this day, the particles that make up dark matter and the field that makes up dark energy have not been directly observed in the lab. Observing dark matter is difficult because it doesn't interact with light, which is how observations are usually made.



But physicists are hopeful that dark matter particles might be produced in the Large Hadron Collider (LHC), where they could be studied. It could turn out that dark matter particles are heavier than anything the LHC can produce, in which case it might remain a mystery for a much longer time.

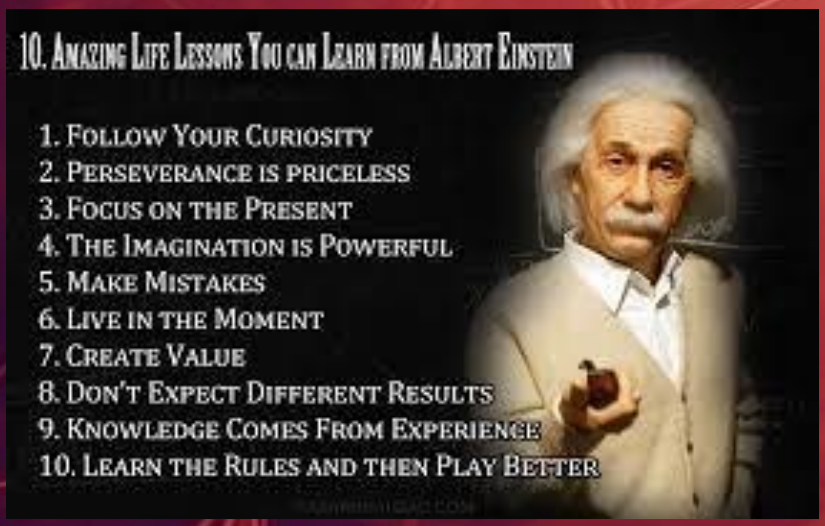
Dark energy is supported by many different observations of the universe, but it's still deeply mysterious. In a very real sense, it may be that "space just likes to expand" and we can only see it expanding when we look at very large scales.

Or maybe the dark matter and dark energy explanations are incorrect, and an entirely new theory is needed. But it would have to explain everything we see better than the current theory before physicists will adopt it. Even so, it's incredible to think that we may know very little about 95 percent of the universe.

Can Anything Travel Faster Than The Speed Of Light?

Since Einstein changed the face of physics with his theory of special relativity, physicists have been sure that nothing can travel faster than the speed of light. In fact, relativity predicts that for anything with mass to even travel at the speed of light, infinite energy is required.We see this in the ultra-high-energy cosmic rays mentioned earlier. They have extraordinary energies relative to their size, but they still don't travel this fast. The speed of light as a hard limit might also explain why communications from alien civilizations are unlikely. If they're also limited by this, signals might take thousands of years to arrive.

But people are continually questioning whether there might be some ways around the universe's speed limit. In 2011, the OPERA experiment had some preliminary results that suggested neutrinos were traveling faster than the speed of light. But researchers later noticed some additional errors in their experimental setup that confirmed the results were incorrect.



If any way of communicating matter or information faster than the speed of light exists, it would undoubtedly change the world. Faster-than-light travel violates something called causality—the relationship between the causes and effects of events.

Due to the way that time and space are interrelated in special relativity, information traveling faster than the speed of light would allow one person to receive information about an event before it has "happened" (according to them)—a type of time travel.

Faster-than-light communication would create all kinds of paradoxes that we don't know how to resolve. So it seems likely that it doesn't exist. But if you do manage to develop it, please tell us about it yesterday.

If this intrigues you too, go on to read further here: https://listverse.com/2017/08/31/top-10-unsolved-mysteries-in-physics/

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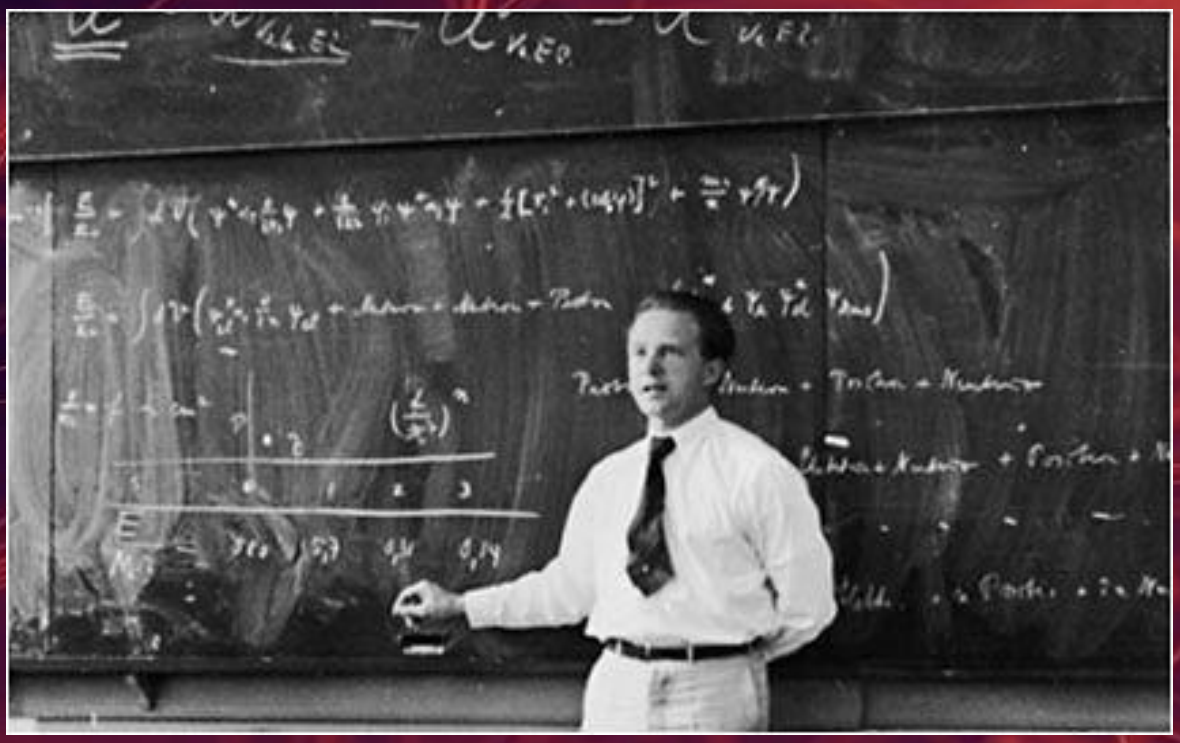
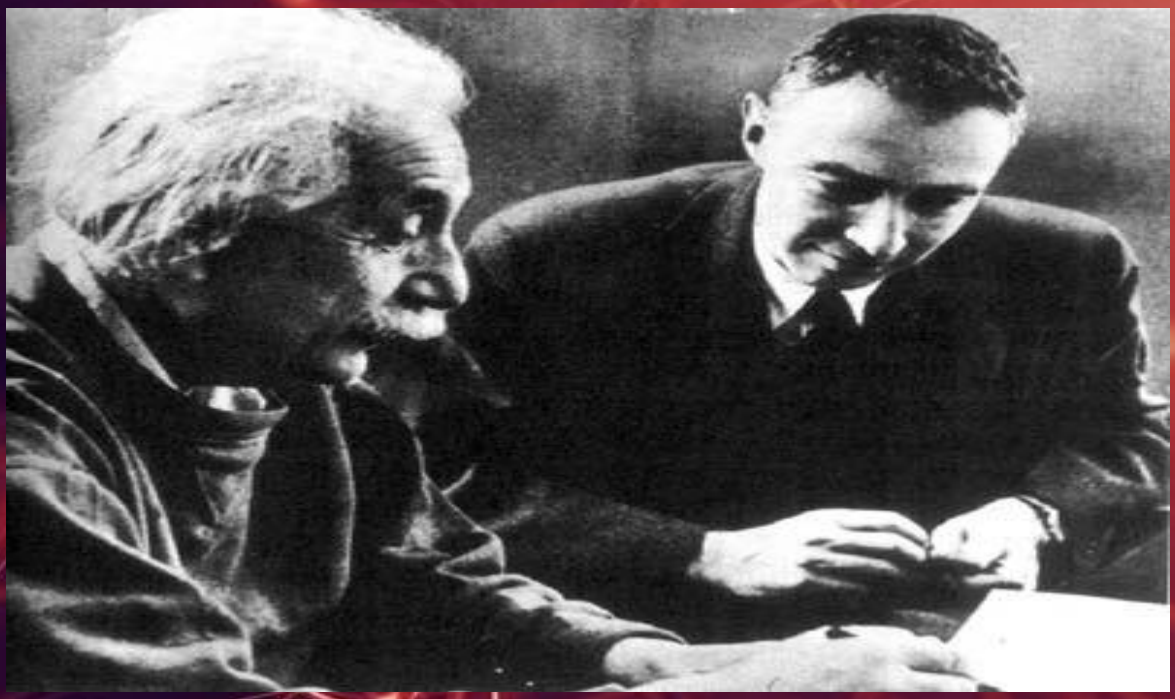
Mad Geniuses: Odd Tales About Famous Physicists

Absent-minded professor

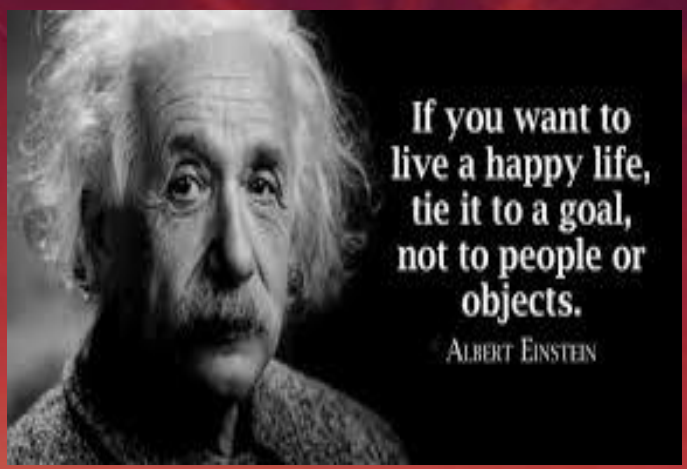


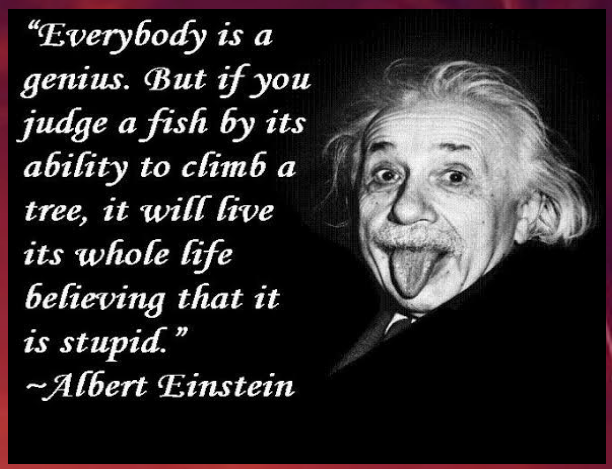
Werner Heisenberg may be the quintessential brilliant theoretical physicist with his head in the clouds. In 1927, the German theoretical physicist developed the famous uncertainty equations involved in quantum mechanics, the rules that explain the behavior at small scales of tiny subatomic particles. Yet he nearly failed his doctoral exam because he knew almost nothing about experimental techniques. When a particularly skeptical professor on his doctoral-degree committee asked him how a battery worked, he had no idea.

Prolific polymath

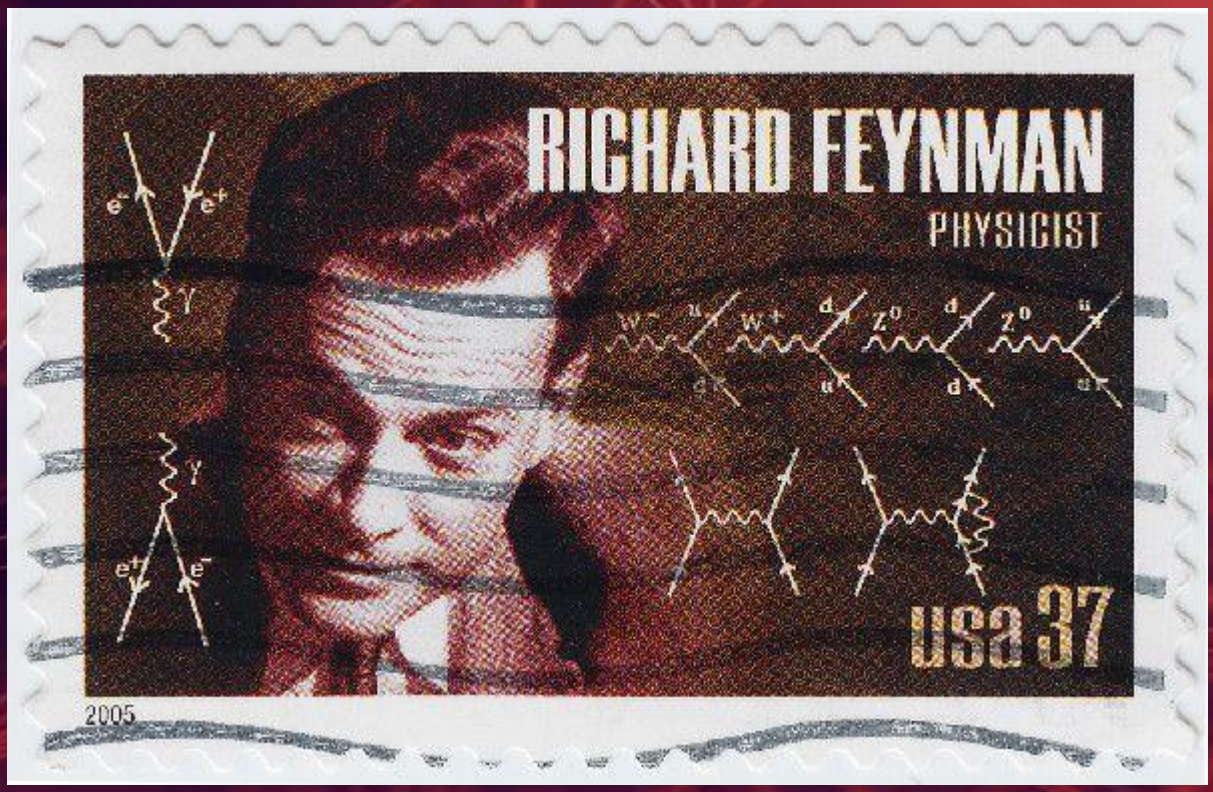


The physicist Robert Oppenheimer was a polymath, fluent in eight languages and interested in a wide range of interests, including poetry, linguistics and philosophy. As a result, Oppenheimer sometimes had trouble understanding other people's limitations. For instance, in 1931 he asked a University of California Berkeley colleague Leo Nedelsky to prepare a lecture for him, noting that it would be easy because everything was in a book that Oppenheimer gave him. Later on, the colleague came back befuddled because the book was entirely in Dutch. Oppenheimer's response? "But it's such easy Dutch!"





Physicist hijinks



Richard Feynman was one of the most prolific and famous physicists of the 20th century , famously involved in the Manhattan Project, the top-secret American effort to build an atomic bomb. But the physicist was also a bit of a practical joker and a mischief-maker. While bored at the Manhattan Project in Los Alamos, N.M., Feynman reportedly spent his free time picking locks and cracking safes to show how easily the systems could be cracked. That wasn't the end of his adventures, however. On the way to developing his Nobel-prize winning theory of quantum electrodynamics, he would hang out with Las Vegas showgirls, become an expert in the Mayan language, learn Tuvan throat singing and explain how rubber o-rings led to the Challenger spacecraft's explosion in 1986.

Andre-Marie Ampere (1775- 1836) was a French physicist and mathematician. He derived a formula describing the interaction between two electrical currents.

As an adult Ampere was plagued by absent-mindedness. One day while concentrating on a mathematical problem, he came on a stationary cab in the street. The back of the cab was a convenient blackboard and, whipping out a piece of chalk, he covered it with calculations. However, after a bit the cab moved off and Ampere watched helplessly as his solution sped away.

Niels Bohr (1885-1962) was an eminent Danish physicist, awarded the Nobel Prize in 1922.

Bohr was awarded a gold medal with the Nobel Prize. He took an active part in the resistance when the Nazis invaded Denmark. When he had to flee Denmark in 1943, he dissolved the medal in acid and hid the bottle. On his return to Copenhagen he retrieved the bottle, precipitated the gold and had the medal recast.

Henry Cavendish (1731-1810) was an eminent English chemist and physicist.

Cavendish seemed afraid of women. The maids in his house were instructed to stay out of his sight or be dismissed, and he communicated with his housekeeper by leaving notes on the hall table.

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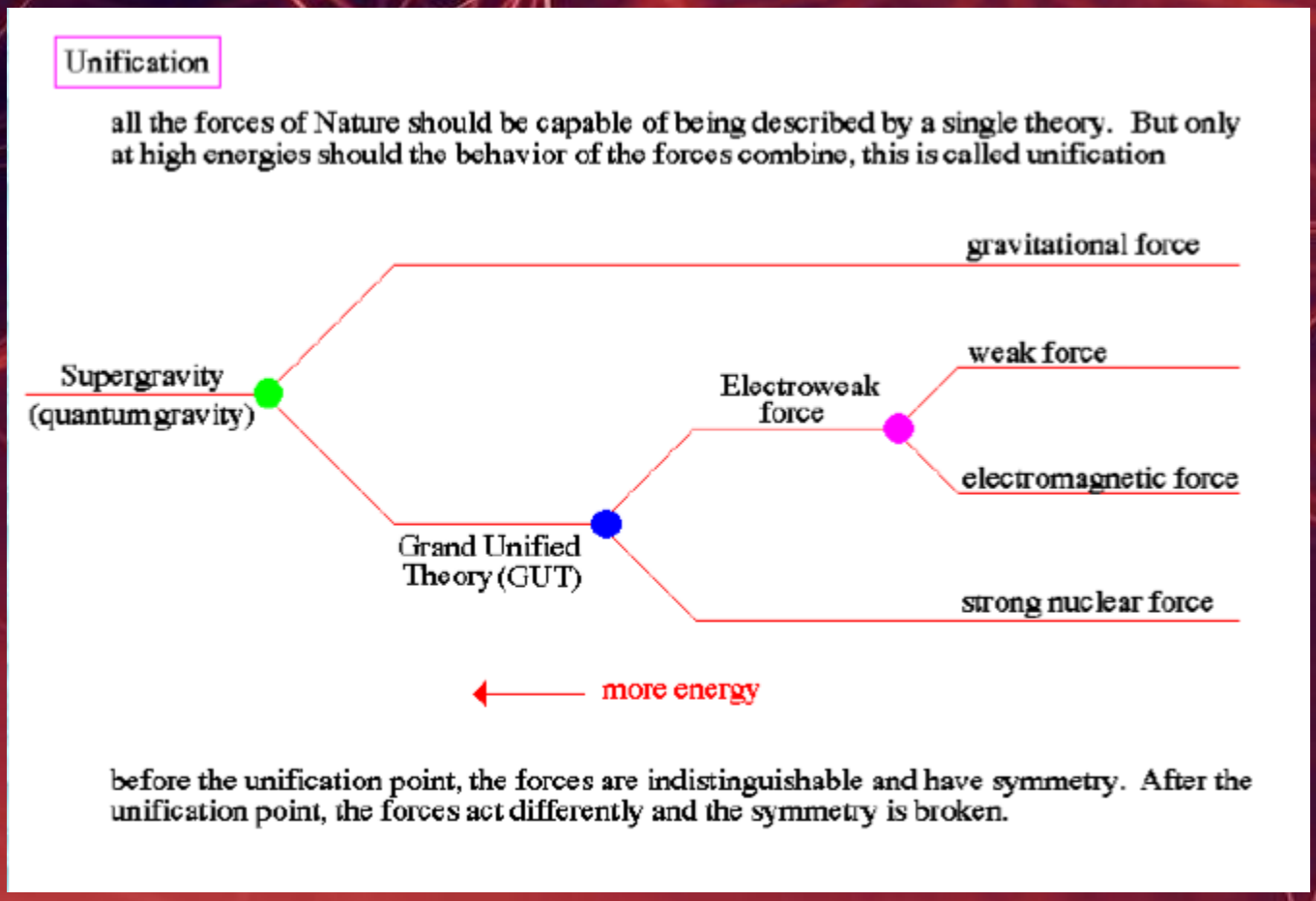
THE ANCIENT QUEST FOR ONE UNIFYING PRINCIPLE THAT GROUNDS EVERYTHING

Humans are part of a large and complex cosmic tradition going back to about 13.7 billion years, when the Big Bang gave rise to the known universe of today! About 4.5 billion years ago the solar system was formed. Further, 3.5 million years ago humans (Homo sapiens) evolved. About 20,000 years ago Neanderthals would sit around the fire at night watching starry sky and listening to the sounds from far. They were trying to understand the world around them.....trying to make sense of life!



And this quest for making sense of life endures till today, though in different forms. From the Ionians of ancient Greece we have made a tremendous leap to contemporary

science. Similar passion has been guiding the contemporary scientist to search for an ultimate theory that unifies everything. Contemporary knowledge of the early universe is at the boundary of astronomy and philosophy since we do not currently have a complete theory that unifies all the fundamental forces of nature at the moment of Big Bang. Our physics today can explain most of the evolution of the universe after the Planck time (approximately 10-43 seconds after the Big Bang). One of the reasons our physics is incomplete during the Planck era is its lack of understanding of the unification of the forces of nature during this time. At high energies and temperatures, the forces of nature become symmetric. This means the forces resemble each other and become similar in strength, i.e. they unify. When the forces break from unification (as the universe expands and cools) interesting things happen and we have the present universe. In the 1930s, when Einstein began his work on a unified field theory, physicists believed that there were only two universal forces that the theory would have to unite: gravity and electromagnetism. They have since learned that there are two other fundamental forces as well, a strong force that binds together atomic nuclei and a weak force that governs radioactive decay. After about fifty years, Einstein's once-lonely quest engages thousands of physicists around the world, most of them working on an ambitious physics framework known as string theory.

But the researchers are still cautious. "There's always something new on the horizon, and then everything starts all over again."

Our quest is still alive-asking big questions, looking for simplicity and searching for one unifying principle that grounds everything.

Manish Singh (reader)

Consciousness is never experienced in the plural, only in the singular. Not only has none of us ever experienced more than one consciousness, but there is also no trace of circumstantial evidence of this ever happening anywhere in the world. If I say that there cannot be more than one consciousness in the same mind, this seems a blunt tautology — we are quite unable to imagine the contrary...

-Erwin Schrödinger

Can you???

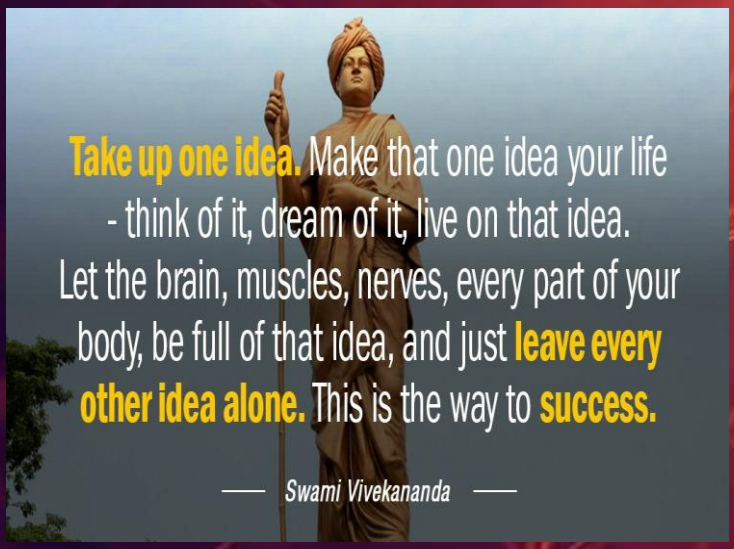
Answers to TICKLE YOUR BRAIN

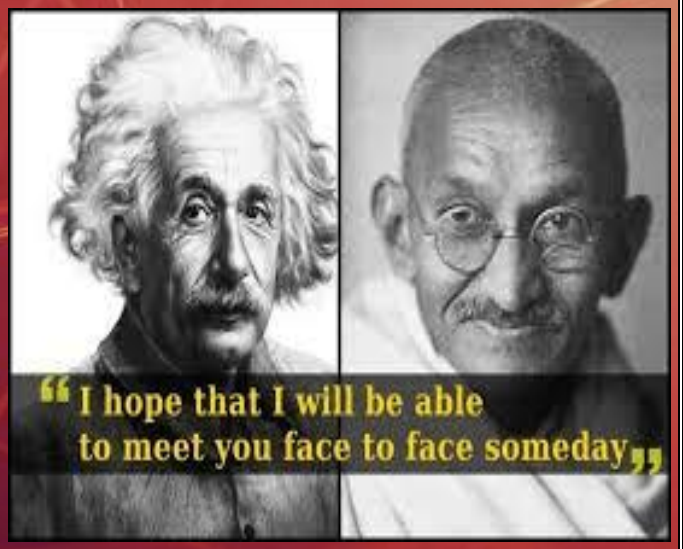
TOP TO BOTTOM

1. Dirac delta
2. Nineteen-o-five
3. Eigen value
4. Current
5. Cesium
6. Pragyan
7. Viscosity

LEFT TO RIGHT

1. Fallacy
2. Marie Curie, in 1903 for Physics and in 1911 for Chemistry
3. Randomness (0 only at 0 K)
4. Spectrum
5. X-rays
6. Refrigerator
7. Roentgen, for his discovery of X-rays





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