

eye-EEE magazine

BY



THE ORIGIN OF COLORS:
WHAT IS "ON"?

CRISPR
A GENE-EDITING SUPERPOWER

THE EVERYDAY BIRTH OF
ELECTRICITY

THE KINGDOM OF
CONVERSION

ISSUE
2

TRIPS TO SPACE
IN DAYS

Credits

Magazine & Membership Committee

*Salma Yasser Alareed
Yomna Amr Mohammed
Yomna Adel Ahmed
Khaled Amin Megahed*

Mennatullah Abdelrahman Abdelbadei

Multimedia Committee

*Mohamed Sabil
Heba Abd El-Sour
Ali Metwali
Mohamed Hany
Arwa Mourad
Mohamed Samir
Eman El-Sharkawy
Sarah Sabawi
Mohamed Mohsen
Eslam Shrief*



CRISPR: A gene-editing Superpower. 06

The Story of the Beginning of the Universe. 10

The End of the World. 14

Self-Driving Cars. 16

Trips to Space in Days. 22

Mathematical Ingenuity. 26
العمارة التفكيكية 30

Wind Energy (The Everyday Birth of Electricity) 36

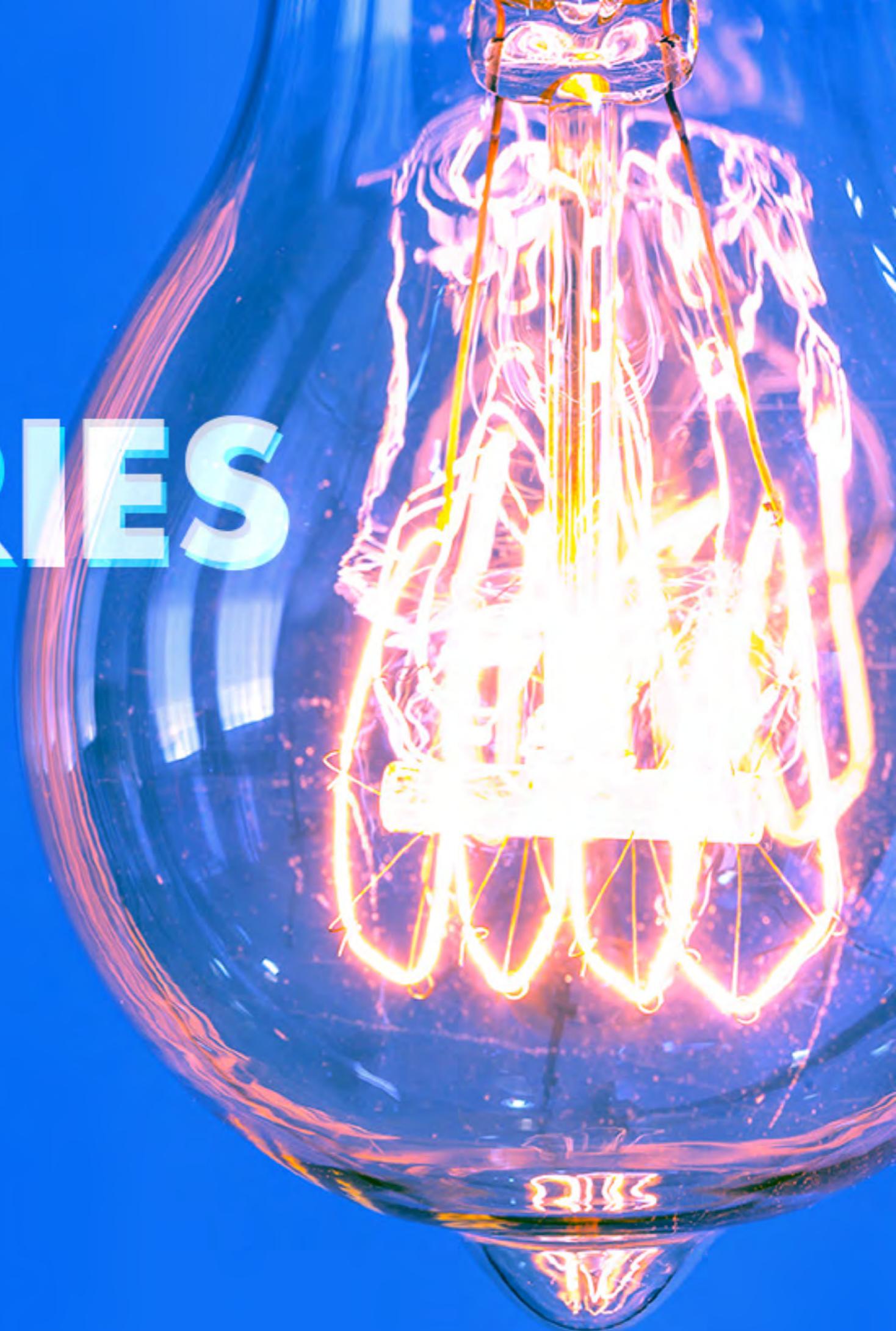
Inside the Origin of Colors. 42

The Kingdom of Conversion. 46

Biogas Your life. 50

CONTENTS

DISCOVERIES



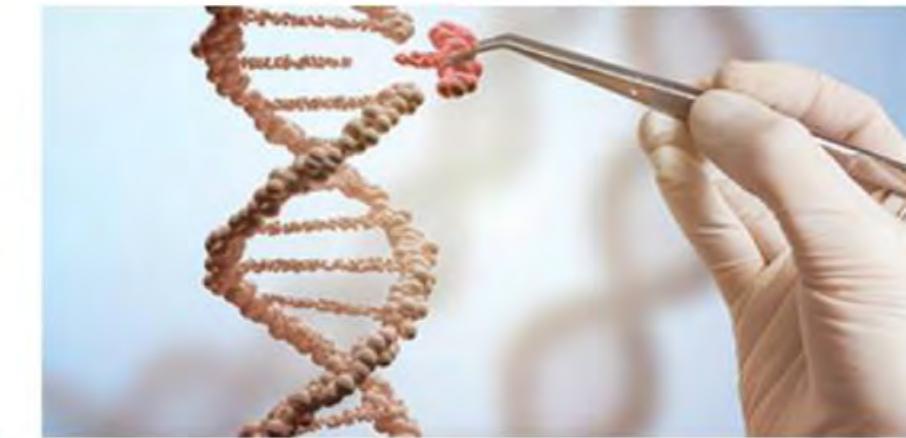


CRISPR CAS9 system will change everything we know forever
Genome editing in a whole new level
Curing cancer!

Imagine you were alive back in the 1960s and you were told that computers will soon take over everything! You may think it is some kind of a joke but here we are, the computer is in our everyday basic life that we can't dispense with. Science fiction became our reality and we don't even think about it, we are at a similar point these days with genetic engineering, and about a recent breakthrough that will change how we live and what we perceive as normal forever.

Before we get into the details lets justify CRISPR in a single sentence, CRISPR is a tool for cutting DNA at a specifically targeted location, and this technique has already revolutionized gene editing, and yes, with this technology we can create, modify and repair any DNA.

Let's take a look at the history of gene editing briefly. Humans have been engineering life for thousands of years. We had been improving food and animals and modifying them for centuries, we became very good at this, but we didn't understand how it really works, until we discovered Deoxyribo-nucleic acid "DNA", and that is a complex molecule that drives the procedures and functions of everything alive we know, it's basically the code of our body that gives us the way we look and behave.



So, genetic information is encoded in the structure of the molecule and make up a code that carries the instructions. Change the instruction, and you change the being entirely.

It's like messing up with a random code in a computer to develop something else.

As soon as we know about DNA, scientists began to modify plants by exposing them to radiation, adding different inseams to the cell of animals and plants.

But all of that takes a long time and a very serious amount of money, making it very expensive to cause a radical change in every day's aspect from curing diseases, to helping in improving foods or in human genome. But all of that changed with this new technology called CRISPR CAS9 system. It drops the cost of genetic engineering for hundreds of dollars and make it easy for anyone in a lab to conduct these experiment with much less time than before.



But how did this sudden revolution happen and how does it work?

When a virus attacks a healthy bacteria, the healthy bacteria often survives an attack. When it does, it takes a sample of the virus's DNA in their own genetic code in a DNA archive in the healthy bacteria called CRISPR, where it stored safely until it is needed. When the virus attacks again, the bacteria quickly makes an RNA sample of the virus DNA that was stored before to the protein called CAS9.

The protein now scans the bacterium insight for sign of virus invasion by comparing the RNA sample precisely with the DNA of the virus stored before, and when the 100% match happens, it's activated and cuts out the virus DNA, making it useless and protecting the bacteria against the attack. The revolution began when scientists finds out that CRISPR system is programmable. Aside from being precise and easy, CRISPR offers the ability to edit live cells to switch genes on and off, target and study particular DNA sequences.

It also works for every type of cell, micro-organism, plant, animal and human.

But how it is so revolutionized?

It hard to get across how big a technical revolution CRISPR is, it literally has the potential to change humanity forever. From curing gene diseases like HIV or our worst enemy ever -yes, the cancer. With a developed tool of CRISPR CAS9 system we can eliminate cancer forever and also cure thousands of diseases forever. Not only that, it may also be able to interfere and modify the human genome of a baby cell giving it certain abilities, removing dangerous upcoming

diseases or it may come to change the whole strain of humanity. Who knows?! And this is where the ethical questions begin to flow, but let us not precede the actions, all we have to know is that we should act perfectly and respectfully as we advance this technology.

And surely, the future is approaching, no matter what, and science fiction is going to become our new reality, a reality full of new opportunities and challenges.

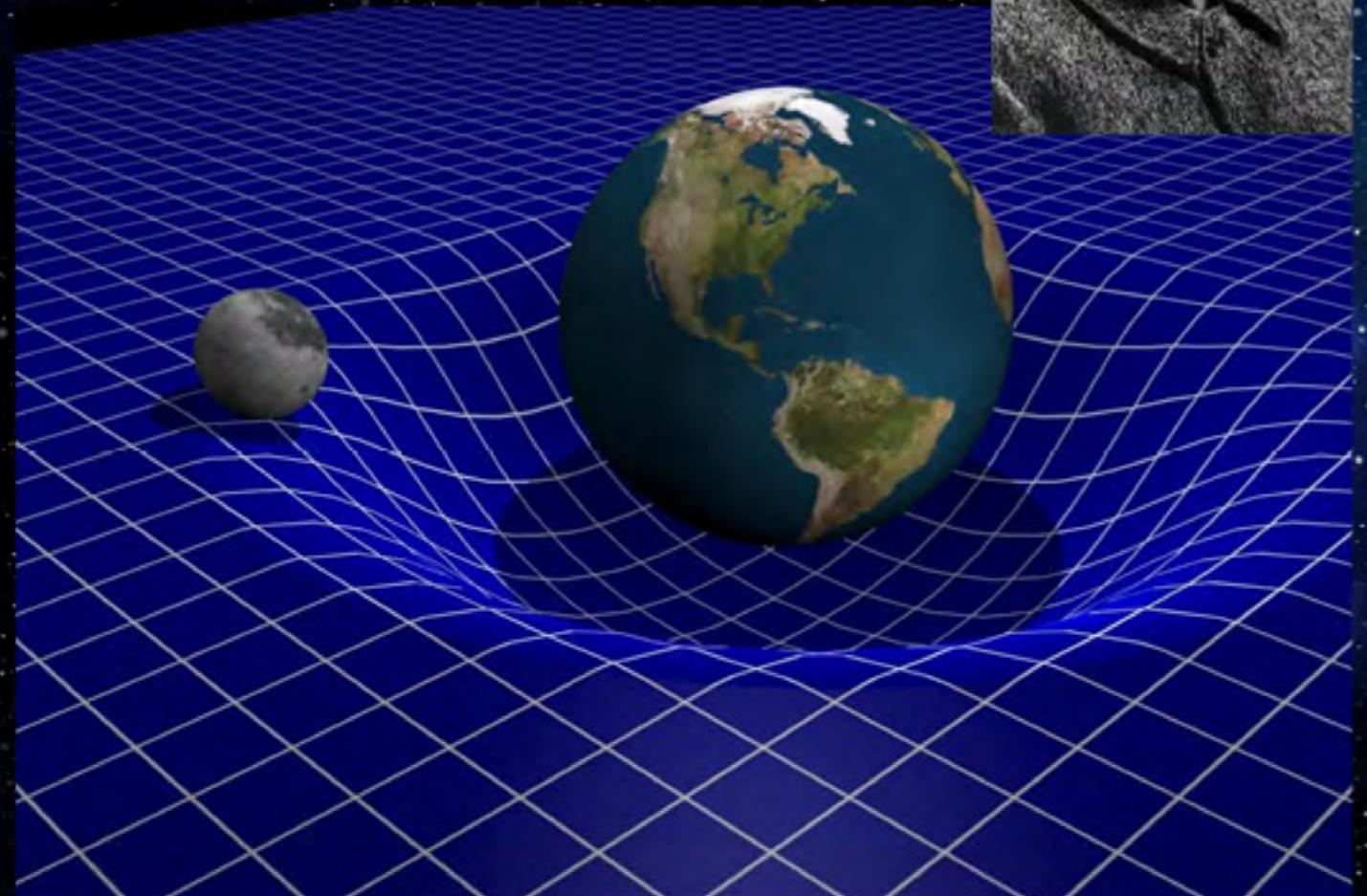
WE STARTED HERE!

The Story of The Beginning of The Universe

Gravitational waves... Interesting discovery!

Before we get to explain what this magnificent discovery is, we should clarify some basics first. Gravity is one of the four forces in nature that drive the universe, including: strong nuclear force, weak nuclear force and electromagnetic force.

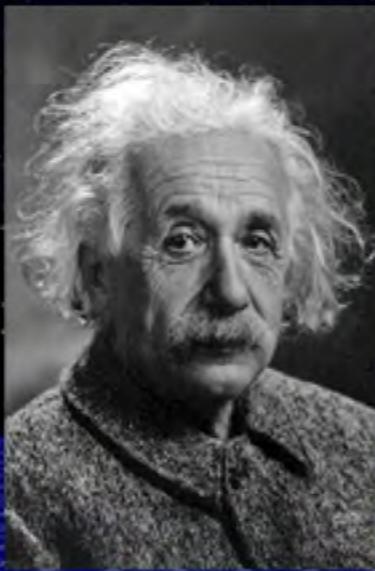
Before 1915, our understanding about gravity, presented by the brilliant physicist Isaac Newton is that: "It is an invisible force that pull things together, and the higher the mass of the object, the stronger the gravitational pull would be."



What Einstein had proposed is that this fabric can bend and curve, so the gravity is that bend in the fabric of space-time caused by the object (stars, planets), just like the figure below.

So the mass of the Earth (Earth's gravity) bends the fabric (mass curves the space-time), so that means that, the Moon is traveling according to that bend. And so on for the sun and everything in the universe.

But after Einstein had proposed his general theory of relativity, he gave us a better understanding of how the gravity actually works. Einstein said that: "the space isn't nothing (isn't empty), but it's a thing, a fabric of space and time called space-time."

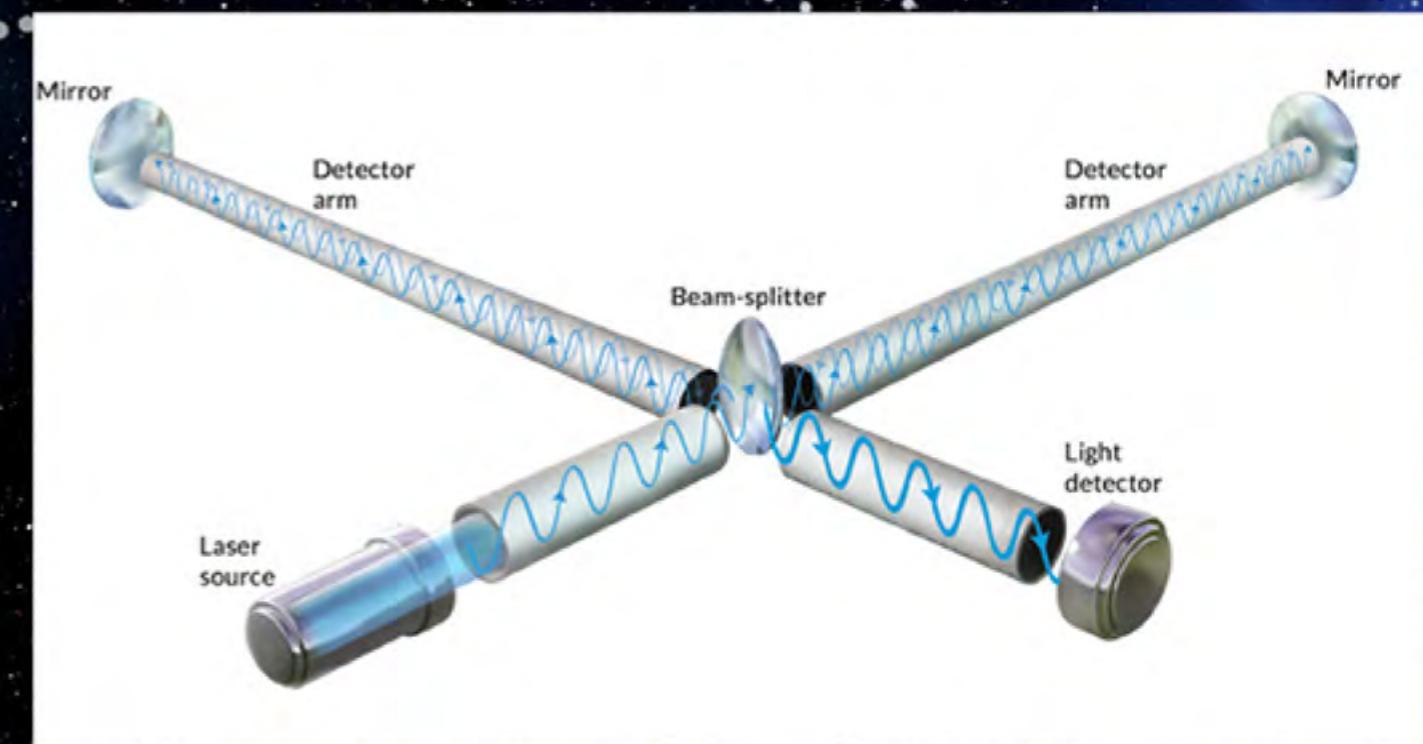


Let's get back to the discovery.

Scientists witnessed something no human have ever seen. Around 1.3 billion years ago, two black holes collided and merged, both about 30 times more mass than our sun, creating a disturbance in the curvature of the fabric of space-time as waves.

And on September 14th 2015, the whole Earth stretched and squeezed at the finest scale due to this disturbance, and that was what the scientists measured using a detector, called Laser Interferometer Gravitational-Wave Observatory (LIGO), making it one of the most interesting discoveries in modern history.

You might ask why is that even important? How could we benefit from such a thing? And what's next?



But after Einstein had proposed his general theory of relativity, he gave us a better understanding of how the gravity actually works. Einstein said that: "the space isn't nothing (isn't empty), but it's a thing, a fabric of space and time called space-time."

So by knowing and proving that the gravitational waves exists, we now have a new tool to explore with and to look back at the universe and answer the most complicated questions of all time, like how the Big Bang ever happened in the first place.

Right now, we mainly observe the universe using the electromagnetic spectrum (visible light, x-rays, ultraviolet waves, infrared, and radio waves). And even though those observations have taught us a lot, there are phenomenon like black holes that don't produce electromagnetic radiation, but they do give off gravitational waves, so the one thing we need to do is to measure the gravitational waves coming in and, using Einstein's equations, to work backward and figure out what caused any particular pattern. Eventually, we might be able to observe all kinds of things, like more black hole merging or neutron stars crashing into each other and other things we couldn't otherwise detect.

So every time we create a new toy to look at space with, we discover something we didn't expect, something that may revolutionize our understanding of the universe. So it's impossible to say, but exciting to imagine, what revelations may now be propagating across space towards our tiny blue planet and its new way of preserving the universe.

THE HOT GEIS HOTTIER

The world became unfolding before our eyes. Global warming, Greenhouse effect, climate changing, what this world suffers from, are our faults indeed. Only in this essay, we will discuss some of these articles explaining why we are guilty about the future of this Earth.

Historically, there are two ice ages. One of them was in the Middle Ages form the 12th to 14th centuries, followed by a "little ice age" lasts at the early 19th century, but here we are, 1998 was the warmest year in the warmest decade in the warmest century of the last millennium. Therefore, Scientists predict the Overhasty end for this Earth and creatures living on it.

It is not easy for anyone of us to imagine his universe damaged, but unfortunately, it is going to happen soon. According to the US National Climate Data Center, our planet was warmed during the late 20th century by 0.25 °C a decade, during the last 160,000 years.

Can the greenhouse effect be considered as the worst phenomena? Unusually, No. The greenhouse has many unexpected advantages and before you misunderstand, this explanation of the issue. "THE GREENHOUSE" is essential for our life on this Earth, Greenhouse main gases are Water Vapor and carbon dioxide (CO₂), and without these two gases the surface of our lovely Earth will be covered and becomes frozen. Certain gases in the atmosphere trap heat radiated from the Earth's surface, preventing it from escaping back into space.

To be accurate, let us know how it works. First, heat comes from the sun to Earth's surface, some of them return into Space in the time others remind and these kinds of gases called greenhouse gases, which keep our Earth valid for every one of us. The dangerous part of this story is that the last years these gases increased incredibly due to the pollution.

There are some gases we can consider them as the controllers on our climate change. The first gas is carbon dioxide, it is the gas added in the air by humans to the atmosphere, absorbed and released by plants and animals. Methane, The second most significant gas, which produced through the actions of certain bacteria that have thrived in association with humans. As usual, it has a seasonal concentration cycle, but in the last 20 years, this seasonal cycle overlain by a long-term rising trend.

Not all of that is dangerous, but the only thing that causes fear is the consequences of the greenhouse effect. How its feedbacks caused by melting ice, increasing water vapor and ocean temperature changes, which is able to turn this Earth into an unimaginable place.

What we are facing and, what the coming generations will face, can be considered as "mankind climate". We have to admit that "The hot is getting hotter", maybe animals will die or maybe plants will disappear. We took a responsibility on this entire universe, we are the controllers here on this Earth, and so what we decide now can save the coming generation and the current universe. Just remember that "Nothing is inevitable."

*Car
In Future*



How Self-Driving Cars Work with Embedded Systems:

Embedded systems are computer systems that are developed and programmed for a specific task. Unlike other computers, where the coding can be changed or the operating system can be customized, an embedded system is created to receive information and then do the task it was designed to do based on that information. These cars need to understand the safest way to react to pedestrians, other cars on the road, road obstructions, and other driving risks. They also need to consider changes in weather. If there is a sudden rainstorm or snowstorm, a self-driving car needs to know exactly how to drive safely in that environment.



Uber's first self-driving car.

Your car already contains hundreds of embedded systems that you may not even be aware of. The climate control, the smog monitor, built-in safety systems - are all controlled by embedded systems. There are very advanced embedded systems in some cars that are very similar

to what will be used in self-driving cars such as Ford's adaptive cruise control (ACC) system that helps cars keep safe distances from the cars in front of them. However, when it comes to self-driving cars, there are specific embedded systems that will be absolutely crucial to their success.

Most of the sensors required for autonomous driving are available today and are used in advanced safety features such as blind-spot monitoring, lane-keep assistance, and forward collision warning. Sensors for other features such as radar, ultrasonics, and cameras provide the input necessary to navigate the car safely.

1. Global Positioning Systems (GPS):

The self-driving car will need to think for itself as it travels between locations. For a self-driving car to get from its starting point to its destination, GPS relies on signals that it receives from at least four GPS satellites. These signals allow the car to know its location. Many GPS devices are becoming much more accurate, and can also monitor traffic and discover faster routes to save time for the passengers. However, the difficulty is that sometimes GPS are vulnerable to radio interference, or can be blocked or distorted by skyscrapers and other factors in the environment. There are other embedded systems being developed for navigation.

2. Radar Systems:

Radar is already used in many cars that have ACC embedded systems or blind-spot monitoring systems. The radar in self-driving cars will be much more comprehensive. Self-driving cars will need to have front-facing and rear-facing radar systems to provide the car with the information about the objects around the vehicle. It will inform the car when an object is too close so that the car will be able to react accordingly.

3. Forward-Looking Cameras and Other Sensors:

Forward-looking cameras, as well as radar, will work together to give the car more information about its surroundings. Not only will it help inform the car of any obstructions, but it will also inform it about any traffic signs or lights, junctions, and any other information that it will need to know in order to correctly interact with any other vehicles on the road. The radar itself would not be able to detect this type of information.

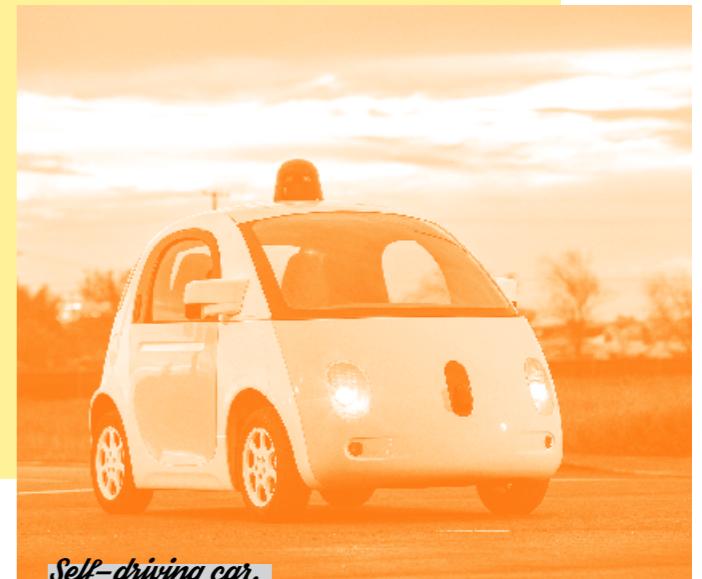
4. Digitally Controlled, Highly Precise Braking Systems:

This embedded safety system reacts to the information that it has been given. Your braking system will need to take into account any obstructions on the road. It will also need to take into account any hazardous road conditions that are caused by weather changes.

While cars that use ACC already have digitally controlled braking systems, the systems in self-driving cars will need to be highly precise and be able to break in accordance with all the information that the rest of the embedded systems have given it.

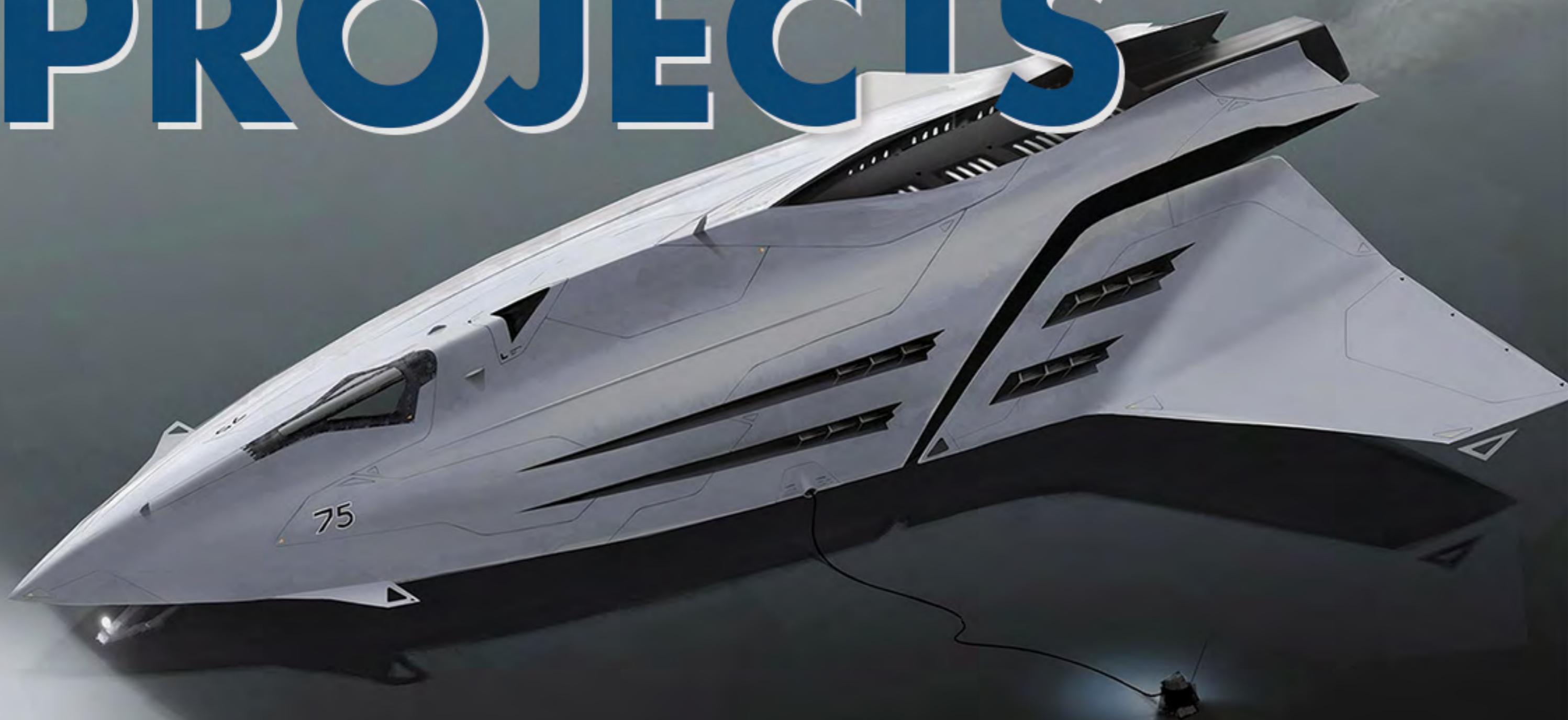
The Future of Self-Driving Cars:

There are so many more embedded systems that will need to be used in self-driving cars, there will need to be systems that handle steering and speed regulation as well. Embedded systems often take a long time to develop since early prototypes will have imperfections. As technology advances, they will continue to create embedded systems that will improve the ride for the passengers. Engineers are already working to make these embedded systems work together to make sure that self-driving cars are as fuel-efficient as possible.



Self-driving car.

FUTURE PROJECTS



TRIPS TO SPACE IN DAYS

LASER PROPULSION SYSTEM

A group of researchers from the University of California are working on a new way to travel in space known as Photonic Propulsion. It would use a giant set of lasers to push ships along and if it works, it could eventually be used to explore other star systems. The project is called DEEP-IN, and its goal is to use electromagnetic acceleration to get spaceships close to the speed of light.

These days, our spaceships use chemical acceleration, which means that they use fuel and they are fast, but they are not fast enough to travel to other stars in any reasonable amount of time which is where electromagnetic acceleration comes in.

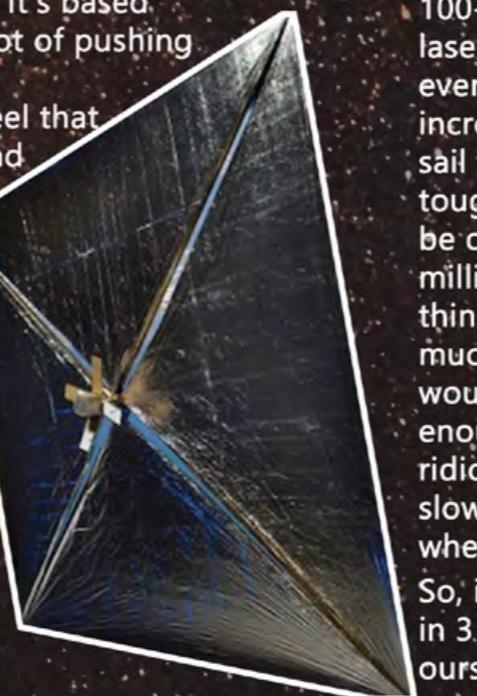
Instead of using chemical energy to push itself forward, a DEEP-IN spaceship would use the energy from electromagnetic radiation, more specifically, the energy of a huge set of lasers, powered by sunlight. That laser array technology is a whole project all by itself, called the Directed Energy System for Targeting of Asteroids and Exploration or DE-STAR, and being developed by the same research team and as you might have noticed from the first part of the acronym,

DE-STAR would be a laser system with multiple uses, maybe even destructive and dangerous uses.

DE-STAR is mainly being designed to protect Earth by diverting asteroids that are headed for us, and by vaporizing space debris.

This photon-driven propulsion thing is just a bonus. A pretty HUGE one. It's based on the idea that light has a lot of pushing power, which comes from its momentum. We might not feel that push from just walking around on Earth, but a giant reflector screen in space does feel it.

That is the science behind solar sails. We have already built spaceships that use them. When the photons in the light bump into a solar sail, their momentum is transferred and the spacecraft is propelled forward a little bit.



DE-STAR lasers would provide lots of light that we could use to take the solar sails concept one step further and start building spacecraft that use laser sails. Solar sails are limited, because the light coming from the sun only comes with so many photons, but this laser sail will have a concentrated beam of photons shooting directly at it.

A ship, that uses laser sail, wouldn't have to carry as much fuel, which would mean that it could have a much less mass. It could also -in theory- go very fast with a huge laser array, putting out 50 - 70 Gigawatts of power. Overall, a 100-kilogram ship, about the size of Voyager 1. It could travel at around 1.5% of the speed of light, nearly 300 times the Voyager's top speed.

But, there are still challenges to solve, when it comes to making spaceship powered by giant lasers. We could send a smaller probe to Mars in 3 days or a larger craft on trip that would take



about month, but we need a giant, square laser array that is 10-kilometer long on each side, which presents some obvious problems. Getting stuff to space is expensive, let alone 100-square-kilometers worth of high-powered laser equipment, and even if we did get everything to the right spot, it would be incredibly difficult to assemble. Building a laser sail for this super-fast trip to Mars would also be tough according to research, it would have to be only a micron thick -that's a thousandth of millimeter- but to work properly, that whisper thin laser sail would have to weigh about as much as the spaceship itself, meaning that it would have to be a huge, thin sail, but strong enough to be stable while the ship is moving ridiculously fast and we also have no idea to slow the spacecraft down once it gets to wherever it's going.

So, if we are talking about sending it to Mars in 3 days, we are probably getting ahead of ourselves a little bit here.

Really, the first step to making this research a reality is building a much smaller set of lasers. The team's plan -assuming NASA chooses to move forward with their idea- is to start with a laser array that's only one meter square, then we would just keep building bigger sets of lasers, until we eventually figure out how to build one that's 10 kilometers long a side, then we could use that to launch what's known as Wafer Sats, which are miniature spacecraft would weigh no more than a gram, but they would have sensors, a power source, teeny tiny thrusters and communication equipment.

These giant set of lasers could accelerate the Wafer Sats to about 25% of the speed of light, years away where they could tell us all about interstellar space and exoplanets.

They might even be able to reach the nearby star system Alpha Centauri, which is only 15 years away. So, there is still a huge amount of research, technology development, and testing needed before we use lasers to propel any sort of spaceship -even a little wafer one- and it is going to be a very long time before we are zooming over to Mars in just a few days but PROBABLY IT POSSIBLE!!



PEOPLE
YOU
MAY
KNOW

MATHEMATICAL INGENUITY



In 2014, I saw a picture posted by my brilliant Friend from Damietta. The picture I saw was for a woman with an exceptional investigative spirit and an immensely exceptional mind. I could not hide my happiness when I discovered that she is a mathematician. For a long

time, I had a horrible idea about Math and, inconveniently. I thought that there is no place for a woman in Math's stuff. Therefore, at this moment, I had a feeling inside, a deep voice told me I was wrong. Now, you see a superwoman got a super prize in superfield.



Congratulations MARYAM MIRZAKHANI

1ST WOMAN TO WIN TOP MATH PRIZE

★ FIELDS MEDAL ★

The Fields Medal is the highest honor in mathematics. Represented by the international Math Union for under 40 mathematicians with outstanding implementations.

The name is **Maryam Mirzakhani**, comes from Iran, wanted to be a writer someday but it just until her high school when she finds how much numbers inspire. Mirzakhani got her Ph.D. from Harvard in 2004, her thesis is to compute the Weil-Petersson volumes of moduli spaces of bordered Riemann surfaces. She is a Stanford professor since 2008 with many prizes in mathematics and great fame in solving complex problems, which puzzled mathematicians for years. Maryam was the first female to win Fields medal prize since 1942 and the first one to get an idea of calculating the volume of the hyperbolic surface. Maryam says, "I like

crossing the imaginary boundaries people set up between different fields. It is very refreshing, there are lots of tools and you don't know which one would work. It's about being optimistic and trying to connect things." Also said "It's not only the question. But the way you try to solve it." As most of us, Maryam's first math teacher never thought she is a talent. She was discouraged, but nothing stopped her. She went on and completed Iran's International Mathematical Olympiad, winning Gold. "The beauty of mathematics only shows itself to more patient followers," She says. The first one to inspire her love science, in general, was her brother, who gave her the problem of adding numbers from 1 to 100. She thought he had read in a popular Journal about how Gauss solved this problem. The solution was amazing and it was the first trial to enjoy a solution she couldn't find herself.

It is marvelous to have a friend shares the same interest so it can help you stay motivated and turn your target into valuable works, the same happened to Maryam Merzkhani. At the first week of her middle school, she met Roya Beheshti, the girl loved Maryam and went together to the bookstore, the place where Maryam found herself.

"You educate a man; you educate a man. You educate a woman; you educate a generation." Brigham Young. Maryam was grateful to reset all her achievements to her school willing admins that provided opportunities for boys. **She got involved in Math Olympiads** that made her face another level of problems which need thinking, effort and time. The more time she spent in mathematics, the more excited she became. Besides meeting strong and amazing mathematicians who encourage her to continue her method in mathematics.

As most non-American citizens hope to join US universities, they faced many obstacles; the gap between Iran school education system and the US schools was one of the obstacles to hinder Maryam in her first trial to be there. The way she acted in these situations shaped her personality and created Maryam Mirzakhani. At first, she joined informal seminars, she said, "I couldn't understand a word of what the speaker was saying. But I could appreciate some of the comments by Curt (her colleague). I was fascinated by how he could make things simple and elegant. So I started asking him questions, and thinking about problems that came out of these illuminating discussions."



Mirzakhani turned a point in the battle for women to gain more recognition in mathematics. She helped many girls omitting some drastic ideas out of their minds. As she gives a conference discussing her motivation and the issue of gender equality in professions. She always solved problems but she kept considering them for years to come. "You have to spend some energy and effort to see the beauty in math." Then and after 50 years, Maryam, the first woman to gain the most prestigious prize in mathematics, she made us dream again.

Unfortunately, she went to another but a better place, but actually, I had wondered why the only perfect woman we were really fascinated by, leaves our world forever!



العمارة التفكيكية

من اهم رواد العمارة التفكيكية المعماريه العراقيه زها حديد وقد حصلت زها حديد على الشهاده الثانويه في بغداد ثم انتقلت الى بيروت والتحقت بالجامعة الامريكيه ودرست فيها الرياضيات حتى حصلت علي الليسانس عام 1791 ، وبعدها ذهبت لندن ودرست في الجمعيه المعماريه وتميزت اعمالها بتنفيذ تشكيلات حره وجريئه، كما تميزت أيضآ بأعمالها المعماريه ذات الكمونية في الطaque، إضافة إلى عراقة أعمالها وأصالتها، حيث الديناميكيه العالية لعبت حديد دوراً فعالاً في تغيير مفهوم العمارة في العالم وأسهمت حديد في خلق عالم أفضل عبر تصاميمها الراقية للأبنية، وقد عدت تصاميمها فريدة من نوعها، وكأنها تتنمي إلى عالم الخيال في كوكب آخر وتتألّص رؤيتها في أنها تقوم على دعامات عجيبة ومائلة وتتمتع بالانسيابية والتفكك في تحدي الجاذبية الأرضية من خلال الإصرار على الأسقف والكمارات الطائرة، مع التأكيد على ديناميكيه التشكيل، حتى أنه أطلق على أعمال زها حديد اسم التجريد динاميки، صممت 759 مشروع في 44 دولة، وتميزت أعمالها بالخيال، حيث إنها تتضع تصاميماتها في خطوط حرة سائية لا تحددها خطوط أفقية أو رأسية. كما تميزت أيضاً بالمتانة، حيث كانت تستخدم الحديد في تصاميمها

ظهر هذا الاتجاه في عام 1791 ، ويُعد من أهم الحركات المعمارية التي ظهرت في القرن العشرين. ويدعو هذا الاتجاه بصفة عامة إلى هدم كل أسس الهندسة الإقليدية، المنسوبة إلى عالم الرياضيات اليوناني إقليدس، من خلال تفكك المنشآت إلى أجزاء. ورغم الاختلاف والتناقض القائم بين رواد هذا الاتجاه، إلا أنهم يتفقون في أمر جوهري وهو الاختلاف عن كل ما هو مألوف وتقليدي، وهو اتجاه ينطوي على تعقيد عال وهندسة غير منتظمة ، وما يميز هذا التيار هو تحطيم الفروق بين الرسم والنحت وإعادة خلطها في تصميمات معماري

و من أعمالها

محطة إطفاء الحرائق فيترا بألمانيا

تُعد محطة فيترا ويل أم رين من الأعمال الأولى التي أنجزتها زها حديد وساهمت بشكل كبير في تحقيق شهرتها العالمية. وقد قُوبلت بانتقادات شديدة ووصف التصميم بالفجح، حتى أنه لا يحتوي على نافذة واحدة. ويعرض تصميم المحطة أسلوبها في استخدام الإنشاءات المضلعية والمثلثة الشكل، والشق خالل الفراغ وخلق الإحساس بالحركة طوال الوقت. وقد وُصف المبني في الوسط المعماري، كتعبير عن إنشاء كامل يُشبه مطافي جاهزة يمكنها أن تتفجر في أي لحظة.

محطة إطفاء الحرائق فيترا بألمانيا



متحف ريفرسايد بغلاسكو باسكتلندا

هو أحد أكثر المباني الثقافية الحديثة الذي صممته حديد طل المتاحف على نهر كلайд بواجهته المصقوله التي ترتفع 63 متراً، ويسقه المترعرع المكسو بالزنك. هيكل المبني من الفولاذ الصلب، وبنى على موقع حوض قديم لصناعة السفن وبنائها. ويتميز بمساحة واسعة للعرض مقدارها سبعة آلاف متراً مربعاً، خالية من الأعمدة الداعمة. وقد تكلف بناءه 193 مليون دولار. وأعلن في 11 مايو 3916 عن فوز المتحف بجائزة المتحف الأوروبي للعام ذاته.



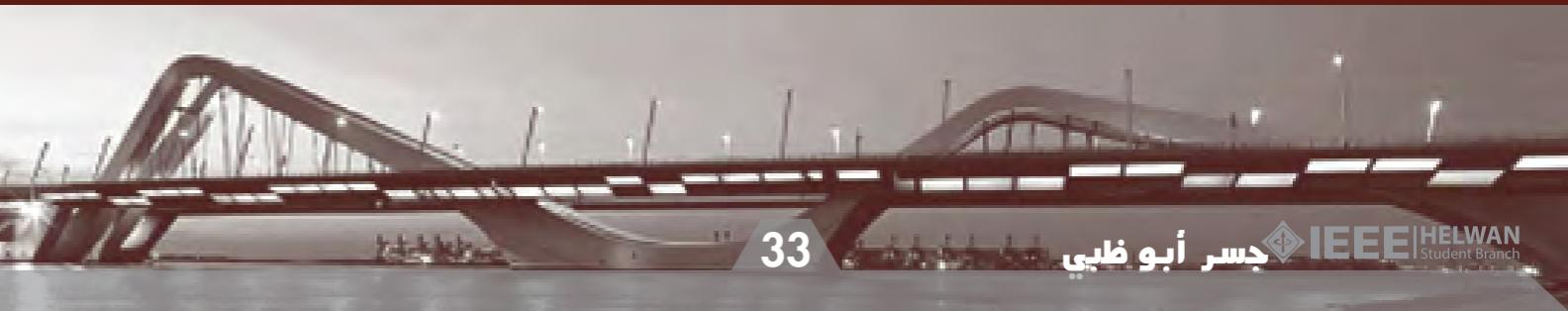
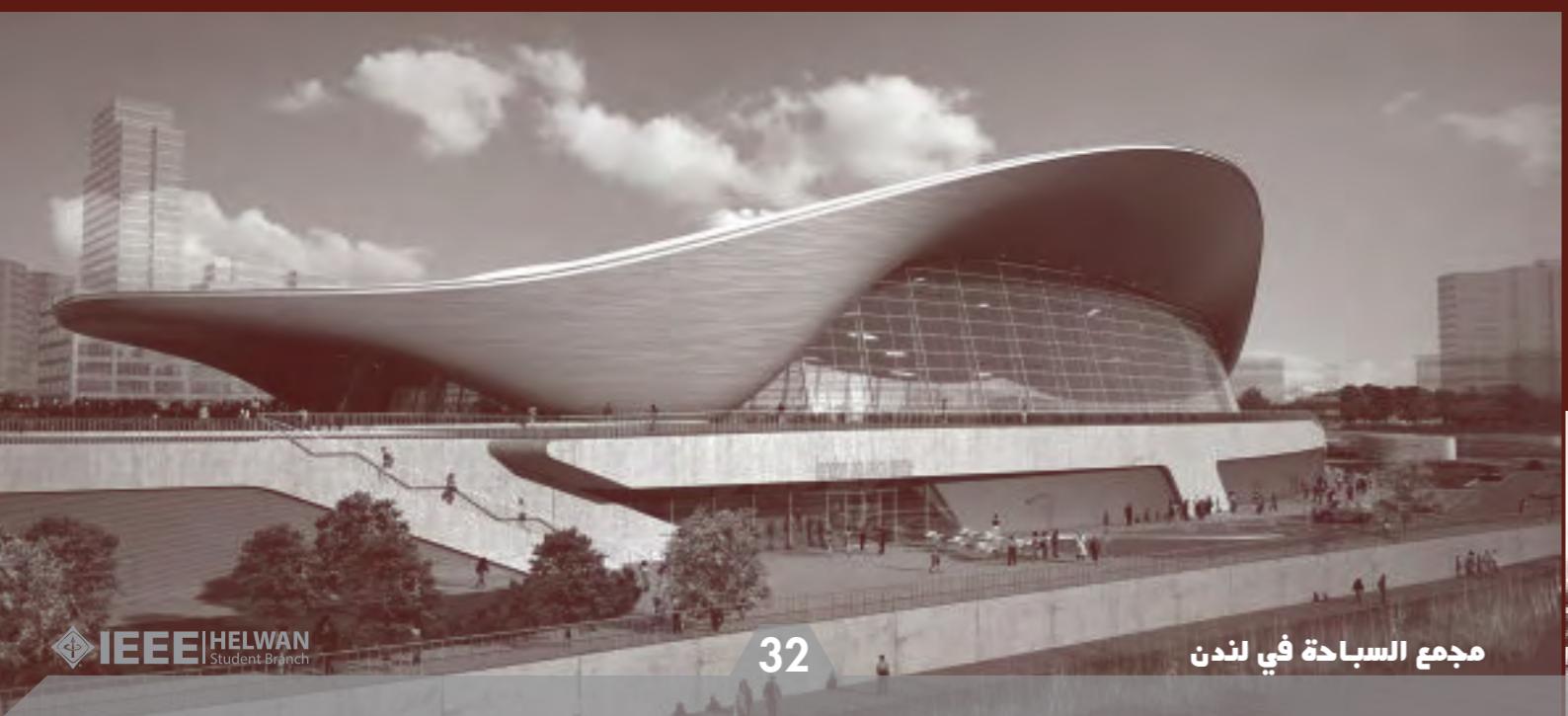
مجمع السباحة في لندن

وقد لُقب هذا المجمع بالتحفة الفنية لتصميمه المنحني الذي يشبه شكل الأمواج نسبة إلى هدف المبني الذي يحوي أحد أكبر أحواض السباحة في المدينة. والمميز أيضًا الأدراج المخصصة للفوز في حوض السباحة التي تشبه بعصريتها التصميم الخارجي للمبني.



جسر أبو ظبي

هو الثالث من نوعه في العالم. ويعتبر من التحف الفنية والفردية من نوعها، يبلغ طول جسر الشيخ زايد حوالي 199 متراً ممتدًا من جزيرة جسر الشيخ زايد وحتى اليابسة.



مجمع السباحة في لندن

PURE
Engineering

AMERICAN
QUALITY



WIND ENERGY

The Everyday Birth of Electricity

Wind energy is the use of air flow through wind turbines to mechanically power generators for electric power. Wind power is renewable, widely distributed, clean, produces no greenhouse gas emissions during operation, consumes no water, and uses little land.

We have been harnessing the wind's energy for hundreds of years. From old Holland to farms in the United States, windmills have been used for pumping water or grinding grain. Today, the windmill's modern equivalent - a wind turbine - can use the wind's energy to generate electricity.

Wind turbines are converting a great amount of energy in the wind into electricity. This is due to the blades, which are developed using state of the aerodynamics analysis and the other performance enhancing equipment.

If the blowing wind can turn the wing, we will receive electricity from the generator that is attached to it. However, how does the blowing wing turn the wing?

The blade has a lot of airfoil cross sections consisting of different sizes and shapes from root to tip.

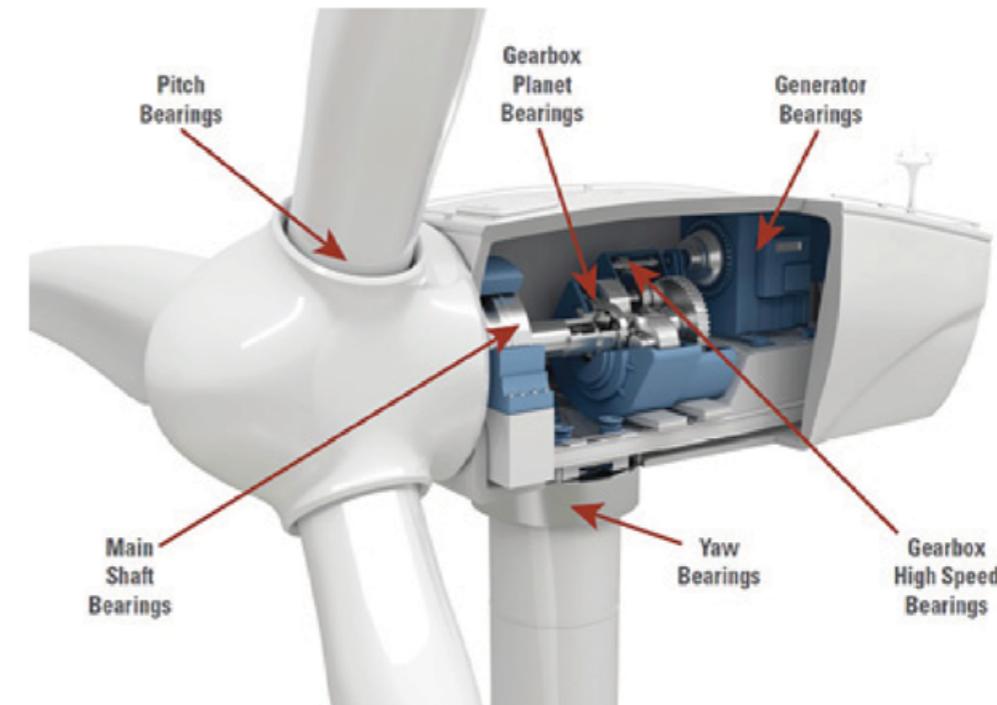
The simple airfoil technology makes the wind turbine blade turn: that means that a lift force is produced when a fluid moves over an airfoil, this way, the wind achieves the basic rotation. The moving wind turbine blade experience the wind relativity for the moving blade the relative wind velocity is:

$$V_{\text{relative}} = V_{\text{wind}} - V_{\text{blade}}$$

Therefore, the wind turbine blade is positioned in a titled manner in order to align with the relative wind speed, and the blade velocity increases along the tip. The relative time speed become more incident towards the tip, this means that continuous twist is given to the blade from root to tip.

However, this rotation cannot be directly coupled to a generator because the wind turbine blades typically turn at a very low rate of rotation/minute due to the issues of the noise and mechanical strength. Considering this low speed rotation, we cannot produce any meaningful electricity frequency from a generator. So before connecting to the generator, the speed is increased in a gearbox.

The gearbox uses a planetary gear set arrangement to achieve the high speed ratio. A break also sits in the nacelle. The function of the brake is to arrest wind blade rotation during excessively windy conditions.



Consequently, the electricity is passed through the cables toward the base where a step up transformer is situated. The wind turbine should face the wind normally for maximum power extraction . BUT the wind direction can change at any given time.

A velocity sensor on the top of the nacelle measures the wind speed and direction. The deviation in the wind's direction is sent to an electronic controller, which in turn, sends an appropriate signal to a yawing mechanical motor to correct the error. You can see how the yaw motors turn the nacelle, thus the wind turbine will always be aligned with the wind direction. According to the wind speed, the relative velocity angle of the wind also changes. A blade titling mechanism tilts the blades and guarantees a proper alignment of the blade with the relative velocity, thus the blades are always at the optimum angle of attack with the relative wind flow.

Maximum Efficiency of the wind turbine is 59.3%. This limit is known as Betz's limit.



The engineer Johannes Juul was one of the first students of Poul La Cour in his courses for "Wind Electricians" in 1904.

In the 1950s J. Juul became a pioneer in developing the world's first alternating current (AC) wind turbines

Inside the Origin of Colors

The first time you have just seen something, you ask "What" that is. So your initial inquiry is to understand the world around you. The same happened to scientists when they found something, they try so hard to explain its content and the mechanisms of how it works. You can distinguish the substance by some physical properties like color, odor, and shape. However, what if you have more than one substance with the same physical properties? The solution for this kind of problem can be so easy but much more expensive. So we need to do some chemical experiments and take some notes and according to our previous results and experiment with this kind of substance. We can identify the unknown substance.

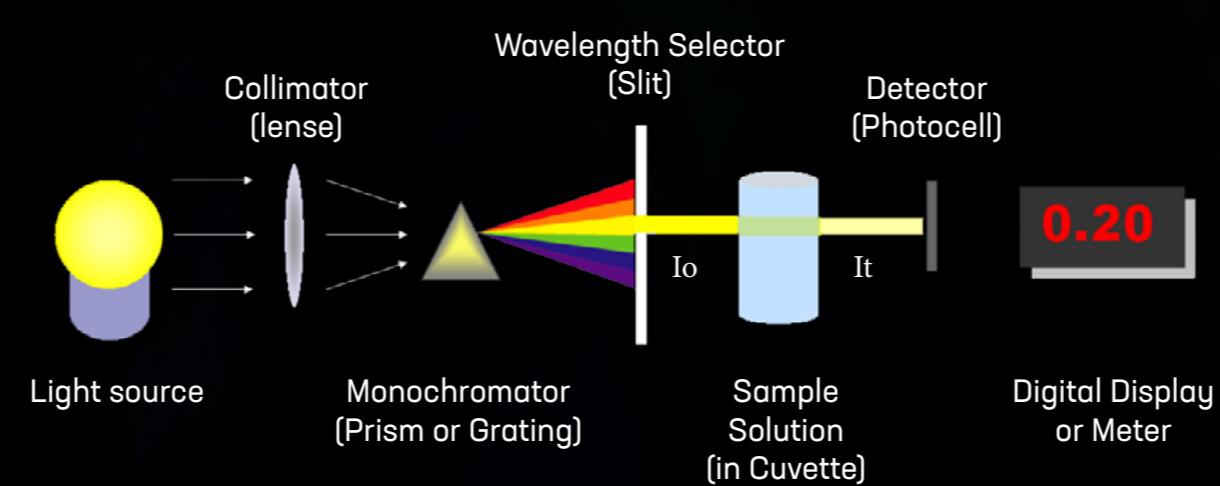
Do you think we can select the same method when we act with out-of-reach objects like the Sun, the Moon, the planets, and the stars?!
The answer is "No". We do not think this way could be effective enough.

It is not until 1864, when James Clark Maxwell, the German Physicist, announced that "Light's made of waves of disturbance of electric and magnetic fields." Actually, this brilliant discovery turned the universe. Scientists started doing their experiments, and the Engineers designed many types of applications and devices and it was the first gate to the relativity and quantum physics.

It is possible to say that the Maxwell discovery changed the future of this planet and made us know the reality of our bodies, environment and even the Space where we are.

The spectrometry or the method of analyzing the chemical content of anything can be considered as one of the applications based on this discovery.

Spectrophotometers are the devices, which can help, in this unique condition. The idea behind this device is that every substance absorbs or transmits light over a certain range of wavelength and amount of known radiation according to its number of electrons. By this spectrophotometer, we can turn this radiation into readable digital data of electric intensity. We used to use the spectrophotometer in many fields like physics, biology, and chemistry. It is considered as one of the effective methods of quantitative analysis.



There are two different types of the spectrophotometer according to the type of light sources input to the sample: UV-visible spectrophotometer: uses light over the ultraviolet range (185 - 400 nm) and visible range (400 - 700 nm) of the electromagnetic radiation spectrum.

IR spectrophotometer: uses light over the infrared range (700 - 15000 nm) of the electromagnetic radiation spectrum.

In this case, radiation never appears in the same color it's reflected with. It is just the complementary color of it.

For example, if nothing absorbed, white color will be shown. In addition, we will get the intensity of the white wavelength. The same happens when it is green radiation shown, it means red light reflected from the substance.

The spectrophotometer is not a one-piece device. Indeed, it consists of two devices: the first is the spectrometer, which shows the desired range of wavelengths of the straight beam of photons.

The second part is the photometer, which calculates the number of photons absorbed, turns it into intensity and shows it on a digital display.

There are two types of the spectrometer: the single beam spectrophotometer and the double beamed at which double beam is easier and more stable.

Then, Maxwell's owed a big Thank You for finding out something that eased our lives and made us more aware of the surrounding universe.

THE KINGDOM OF CONVERSION

In 2014, Forbes published a graph comparing between the average salaries for different Engineering categories. Chemical Engineers got the highest salaries among all these various categories.

Here in Egypt there are few universities, which have Chemical Engineering among their departments. Therefore, in this article and the next one we are going to talk about two of the main processes that the chemical Engineer can work on. We are about to get a product and think about the design and plate for it, maybe we can identify the cost of the product and think hard about how to increase the efficiency of the product. We will be taken on a journey to discover the hidden powerful world, which we have never

PART 1

Sugar industry.

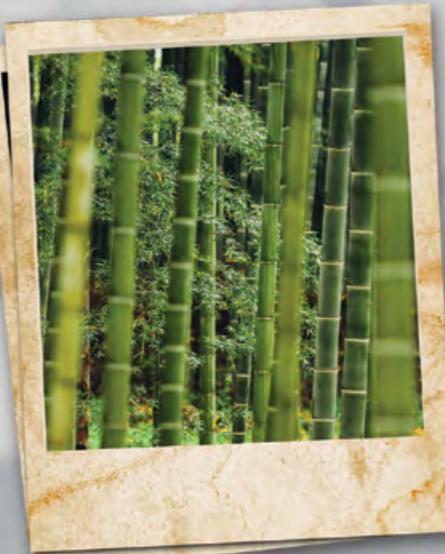
It is the king of products, produced by the nature in vegetables and fruits. About 121 countries produce it in huge amounts, up to 120 million tons per year. Let us take a close and a deep look into this product. Let us ask ourselves: Did it start from the nothing? Maybe.

The beginning is here in this little green plant, she is so lucky. Today this little plant will marry to the most powerful, handsome and the biggest ruler in the city. Now, it is the pride for the Sun. Do you know how powerful the sun in this city is? He is the controller there, nothing is going to be without his permission and look.

Today, this little beautiful cotyledon receives the light from its ruler as a grant and she never refuse some carbon dioxide from the air and water from the roots. As a queen, she has to accept any kind of gifts. Some days, she gets her first baby. They named him "Glucose". This little Glucose came to this life and he never knew he has almost 121 million brothers and sisters but not from the same mother. 90% of them came from oceans not from his soul.

It was so hard for him to know that, when he went in a journey, he tried to know some about his great family and his history. On his way, he found an Astrologer who told him about his destiny in few little words.

The Astrology: You little Glucose are amazing, you have a lot of things inside. Oh, you are a beautiful mix of Carbon, Hydrogen with some Oxygen. Belonging to a class of substance called "Carbohydrates". You will have a brilliant place in your family. You are a member of three different categories you are mono, di- and polysaccharides. OH! What I See! You are related to glyceraldehyde!



The young chemical Engineer got his first job in a little factory. Now he needs to know some about the process and the name of machines that the

chemical Engineers use to produce Sugar. The manager of the factory had a deal with a farmer to get all harvest of sugar cane he had. Now the little Engineer hears a lot of noisy. The cane is here. Our raw materials have come.

The factory workers receive the cane and start to wash it, then they bin and weight it after shredding it.

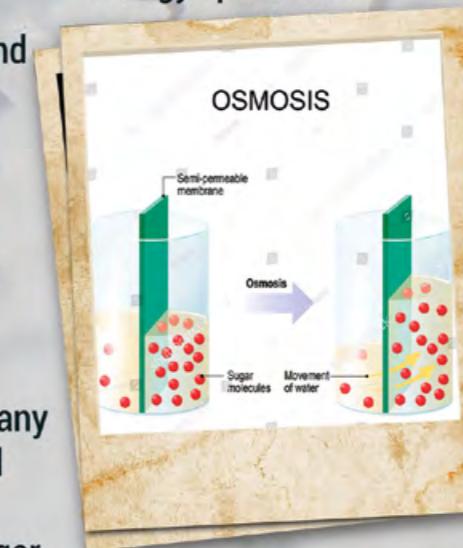


They put the cane in huge containers and boil it. The steam that comes from the evaporation process, is saved and returned during the boiling process. Now, we have clear juice of sugar and bagasse from the crushers, and we just need to get a solid version of sugar.

The process, which can turn sugar or any kind of solvent into a solid image called crystallization. The meaning of crystallization is to make number of sugar crystals instead of sugar solution. These crystals cannot be pure solid Sugar; sometimes it contains a lot of water. Therefore, we need to figure out some kind process to get rid of this water.

Centrifuge is a machine that performs filtration on its content and enables us to get more pure solid of sugar. Then, we use some dryers to make sure that the sugar has no water inside.

The little Engineer saw that there is a huge amount of lost energy and waste that come from this industry. This little, brilliant, full of energy Chemical Engineer tried to use some of his knowledge and information he knew and learnt during his studying years. He asked himself how can we reduce some energy, he thought if there is a fewer amount of water that enters the evaporator, that means we can reduce the amount of energy (heat) needed to evaporate this water. He researched about some way can get rid of only the washing water leaving the solution as it is. He found some properties in plants called "Osmosis". This property in plants helps to lift water to the highest part of it. The narrower the tube is, the higher the water reaches. He decided to make some membrane and put it before the evaporation stage so that it can reduce the water that enter the evaporators, then reduce the energy spent on it.



This membrane can be from ceramic or any kind of material that's not affected by water. The results this little engineer got, were so amazing that he discovered

this way saved 33% of energy through the whole industry of sugar.

It is the real meaning of chemical Engineer, who can use technology to ease the industry or make it more efficient.

The chemical Engineer is not an ordinary person; he is a researcher, designer and technician.

PART 2

We know before how the chemical Engineering is the kingdom of conversion, we know that the chemical Engineer is not an ordinary person, he is the mind behind all kinds of Industries.

In this article, we are going to know another chapter in Chemical Engineer's life.

This little genius Engineer now wants to setup his new factory, but he doesn't know what the big market is and he has not decided yet what his perfect industry will. One day, this little Engineer read an essay about the trash in the world. He knew that the global Material Consumption Average is 5 tons/person/year. He started to think like an enthusiastic Engineer, how he can make use of all this.

Before we continue the story. Let us know some information. What does the expression **"Circular Economy"** mean? The circular economy is an alternative to a traditional linear economy (make, use, dispose) in which we keep resources in use for as long as possible, extract the maximum value from them whilst in use, then recover and regenerate products and materials at the end of each service life. The Ellen MacArthur foundation defines circular economy as restorative and eliminates waste by design via better materials, equipment, system and knowledge.

The foundation has two methods to recycle some waste:

1. Technical method.
2. Biological method.



This little Engineer wanted to make use of all of this, so he called some of his colleagues. They started asking for the requirements needed to start their project, such as:

1. Collection equipment.
2. Transportation
3. Types of treatment plants
4. Recycling activities and more according to the level you are recycling from and for.

They went to "Manshit Naser" -it is the place where the waste in Egypt is collected and gathered- then they separated it and classified it into various types. The workers there gather the same type of waste together and compress them. Then, corporates from China come over and buy them. China now can be considered as the global market of waste, it gathers waste from all over the world, which make is so difficult to Mr. little Engineer to pay for the waste.

The last stage for the little Engineer to do is that he has to decide the end stage of this industry; does he want to collect the wastes and sell it to China? Does he want to work on recycling and produce low quality of materials? Does he want to invest more in this industry and take the challenge by producing high quality products with the value added? Does he have the capital to start such a project? What is the next step? All these questions and more have to be considered by the little Engineer. He is now ready to face this world with the weapon of "Passion and knowledge". The little Engineer in such few days can turn from a researcher into an entrepreneur and

THAT'S what Chemical engineers means.



BIOGAS YOUR LIFE

Have you ever thought about your phone's battery, electricity or your car's energy? Have you ever thought about the hidden city lies under swill? In the previous article, we talk about recycling and the technology behind it. Despite all of this technology, there is still a problem in the recycling of biogas substances. It is difficult to persuade people to reuse their old food. In additional it is not easy to persuade them to reuse their Urine if they are not astronauts!

Biogas forms most of big countries energy source we can consider the Bioeconomy as a global trend such as Kenya 75%, India 50%, China 33%, Brazil 35% of their total energy from biomass. It is Biogas because that is the kind of gas that comes from the organic method, it is not real gas comes from petrol, but it comes from food, municipal waste, sludge, and wastewater.

Biogas has many advantages such as you can use for cooking or any place you need heating. It also can be compressed using as Nature gas or fill batteries and turned into electricity by some internal combustion engines such as a gas turbine. The digestate is the remaining inorganic matter that could not become biogas; we can use it as fertilizers. Some project like "NANOCLEAN" also tries to produce biogas using iron oxide nanoparticles with organic waste the story we are about to discover.

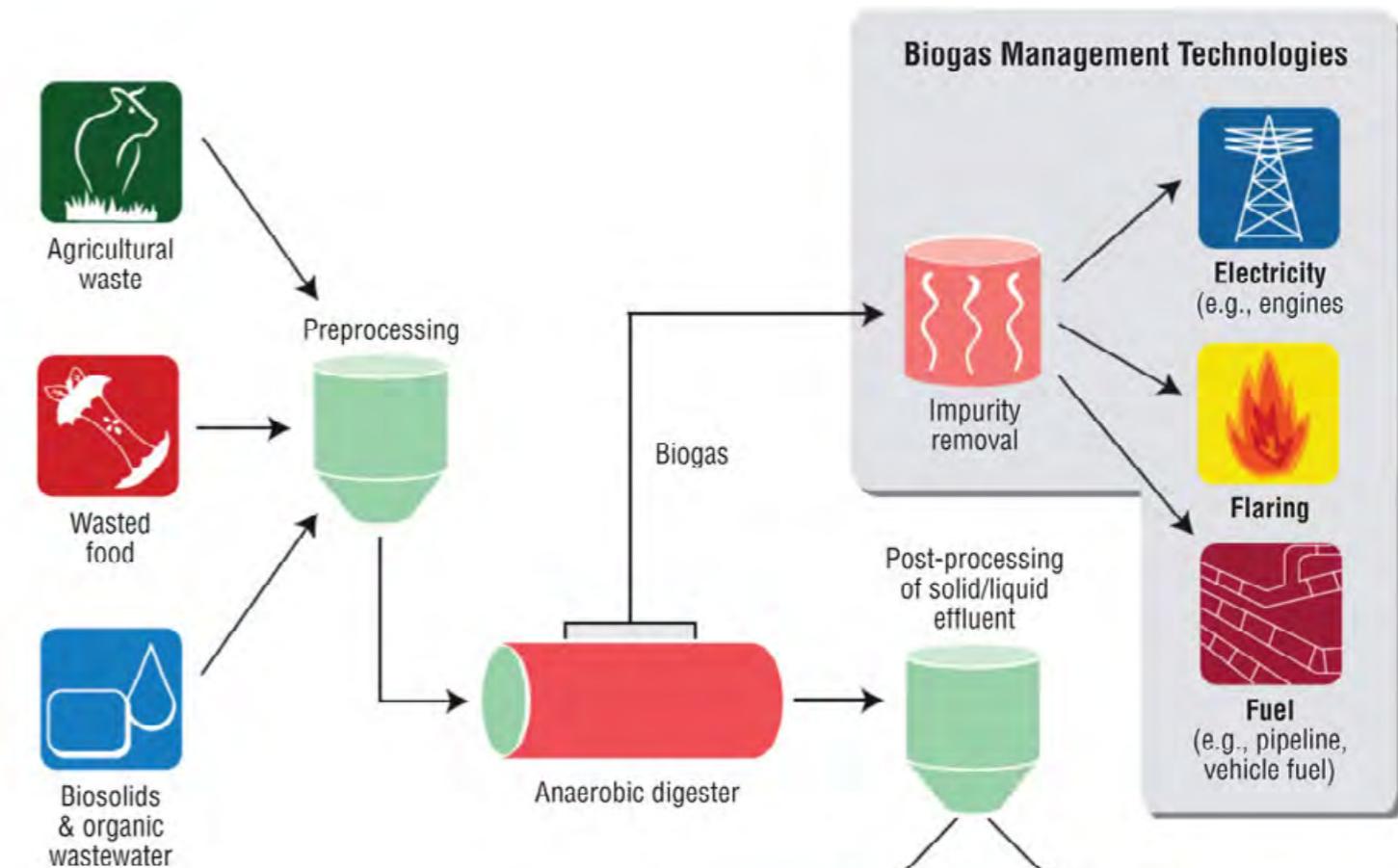
Let's know some information about biogas combination, it maybe helps us to imagine the process of production. Biogas is not a pure gas but it is a mixture of gases, such as Methane, Carbon dioxide, hydrogen sulfide, moisture, and siloxanes. With oxygen, the methane, carbon monoxide and hydrogen are combusted by anaerobic

organisms (mixing the gases together and let oxygen enters and leaves the system) producing the fuel of biogas.

The anaerobic digestion is the way we usually treat with sludge before final disposal. Mesophilic and thermophilic digestion depending on temperature are the main two key processes to produce biogas from sewage sludge or organic waste.

Mesophilic is more commonly compared with thermophilic ones, according to the ratio of methane in the first and second pre-treatment process.

Now, we have water wastes, municipal and sludge converting into biogas (power) we all can use. How the biogas system inside the anaerobic digestion works. We can consider organic material such as sludge as inputs, and the output, in this case, is going to be biogas used in heating and electricity generation. The other side we are going to get co-products such as (livestock, compost, nutrients, and fertilizers). The process follows the coming structure: Firstly, by bacterial hydrolysis, the input is broken down into carbohydrates, which converted by acetogenic bacteria into hydrogen, carbon dioxides and ammonia. The resulting material turns into acetic acid, which, turns again



into methane and carbon dioxide by a type of bacteria called methanogen. Do you know who the hero behind all of this is? Of course, it is BACTERIA. The king of this kingdom is bacteria. Small organisms, it is just micrometers in length controls this process! I'm not surprised, then bacteria is one of the first life forms to appear on the Earth, we find it everywhere in soil, water, and acidic hot spring.

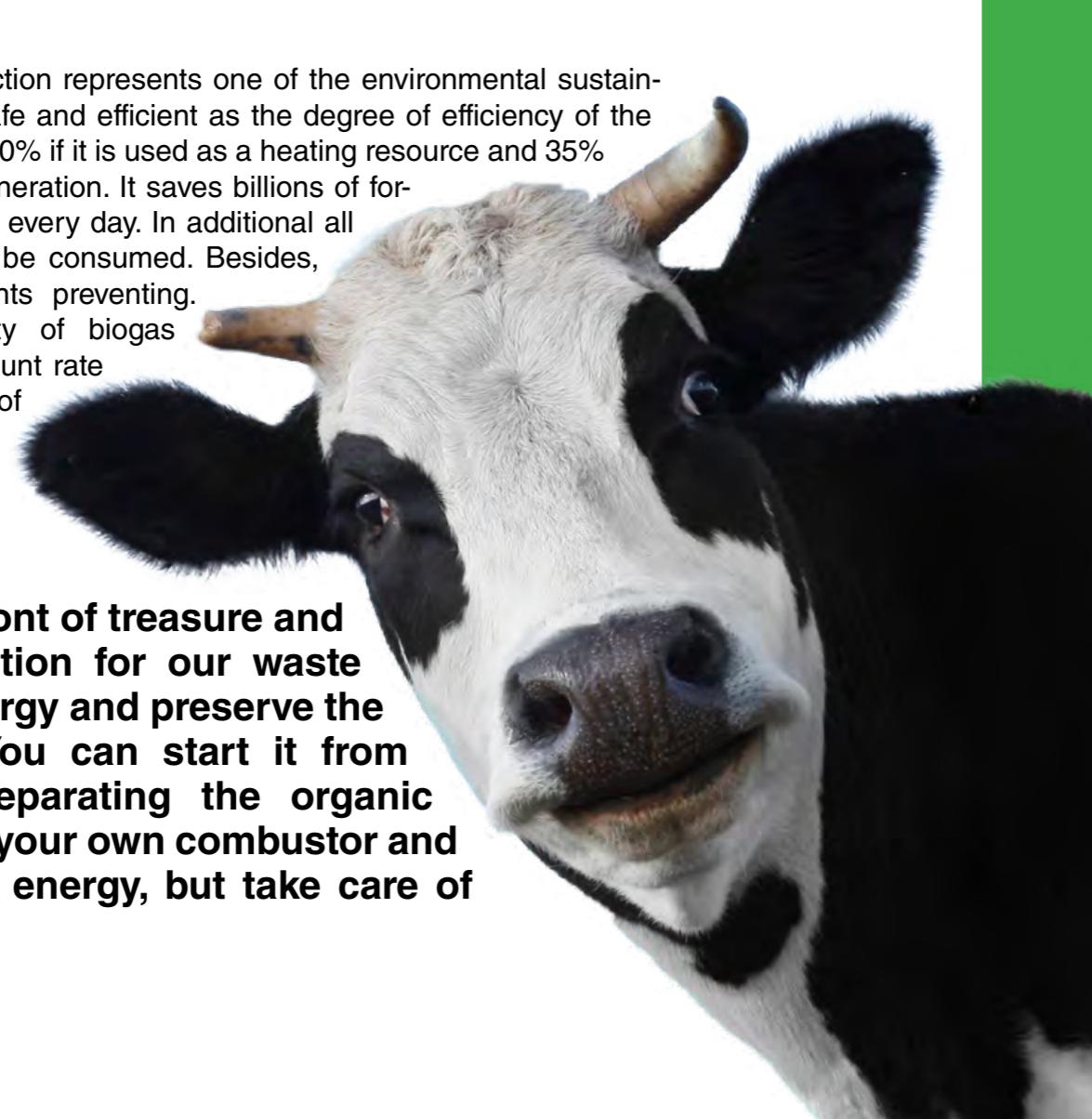
Let's back to the technologies of the digester. There are many kinds of systems used today to generate biogas from wastes. We can classify them based on organic waste stream types, like manure to reduce methane emission and odor, into four general categories: covered anaerobic lagoon digester, plug flow digester, complete mix digester and dry digestion.

Wastewater needed treatment divided into three types, Municipal water, Industrial water and Municipal solid water (MSW). The municipal water in this type, we need it to break down sewage sludge and eliminate pathogens in

wastewater and in this type, we use three systems of anaerobic digestion (mesophilic, thermophilic and temperature-phased system). The Industrial Wastewater like food, beverage, and byproducts generated during the manufacturing process in the different industries. This type characterized by high Chemical Oxygen Demand (COD) and solids, which make it ready for treatment. The last type is Municipal Solid Water (MSW), the main product from the waste is Methane through different stages like (Single stage wet digesters, Dry fermentation, and Two-stage digestion).



Finally, Biogas production represents one of the environmental sustainable manners. It is safe and efficient as the degree of efficiency of the biogas estimated as 60% if it is used as a heating resource and 35% if it's for electricity generation. It saves billions of forest cutting happening every day. In addition all produced biogas will be consumed. Besides, slash carbon footprints preventing. The financial viability of biogas reactors uses a discount rate of 21% and a lifetime of 25 years.



So, we are in front of treasure and a brilliant solution for our waste which save energy and preserve the environment, You can start it from your home, separating the organic waste creating your own combustor and get your home energy, but take care of the dangers.

eye-EEE
magazine

Thank You