

# PARAM SCIENCE MAGAZINE

## MAY 2023 SCIENCE DAYS

11th May: National Technology Day

17th May: World Telecommunication Day

18th May: International Museum Day

20th May: World Metrology Day

22nd May: International Day for  
Biological Diversity

## MAY 2023 BIRTHDAYS

11 May 1918: **Richard Feynman**

13 May 1857: **Ronald Ross**

17 May 1749: **Edward Jenner**

18 May 1952: **Venkatraman Ramakrishnan**

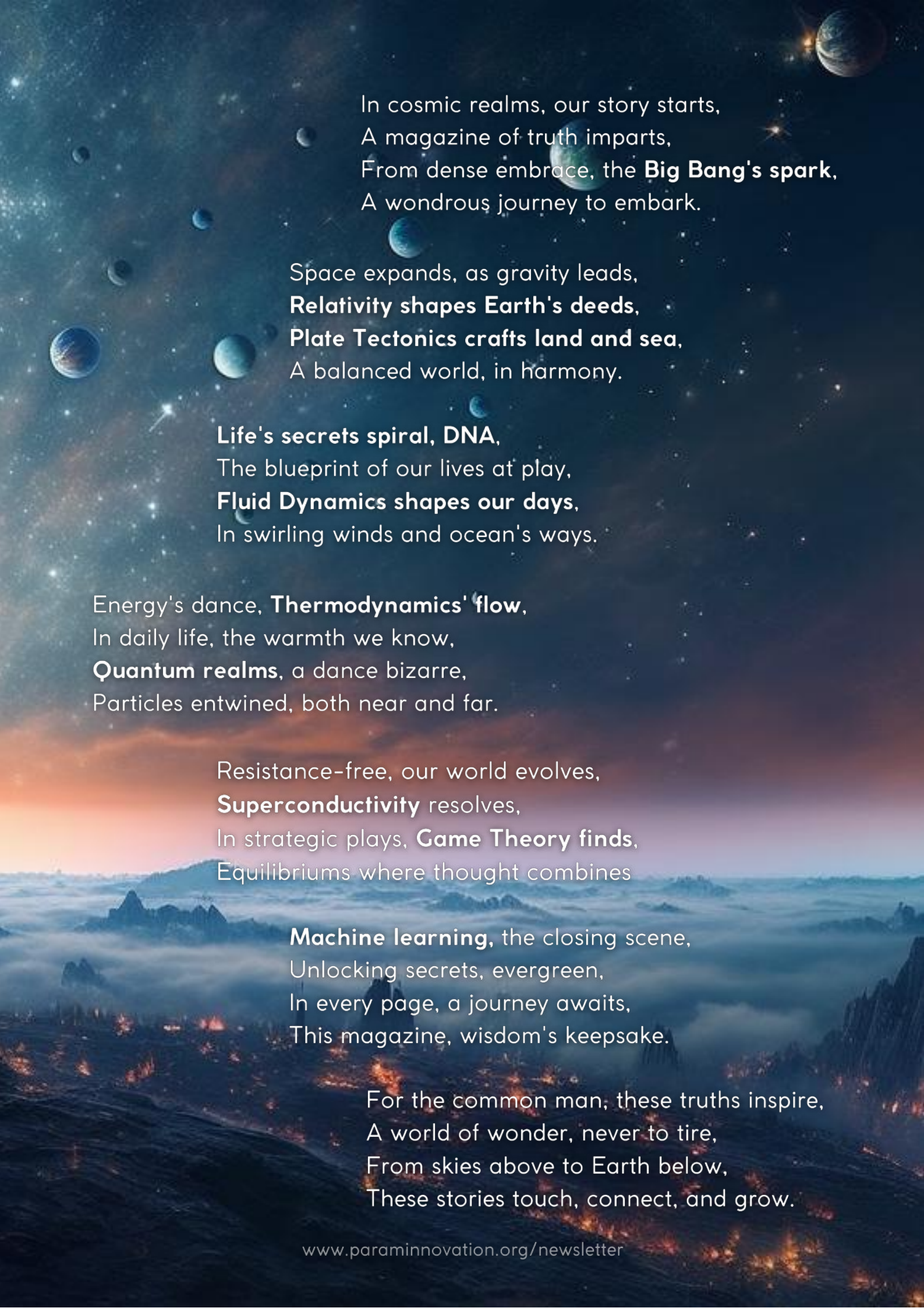




This edition presents a captivating journey through 10 scientific theories distilled into six sentences. Admire the practicality on the left page and the theories on the right. Experience the joy of understanding these intriguing concepts, all explained in simple language.

April 2023



A cosmic background featuring a deep blue and black space filled with numerous stars of varying brightness. Several planets are visible, including a large Earth-like planet in the upper right corner and several smaller, blue and white planets scattered throughout the scene. The overall atmosphere is one of vastness and wonder.

In cosmic realms, our story starts,  
A magazine of truth imparts,  
From dense embrace, the **Big Bang's spark**,  
A wondrous journey to embark.

Space expands, as gravity leads,  
**Relativity shapes Earth's deeds**,  
**Plate Tectonics crafts land and sea**,  
A balanced world, in harmony.

**Life's secrets spiral, DNA**,  
The blueprint of our lives at play,  
**Fluid Dynamics shapes our days**,  
In swirling winds and ocean's ways.

Energy's dance, **Thermodynamics' flow**,  
In daily life, the warmth we know,  
**Quantum realms**, a dance bizarre,  
Particles entwined, both near and far.

Resistance-free, our world evolves,  
**Superconductivity** resolves,  
In strategic plays, **Game Theory finds**,  
Equilibriums where thought combines

**Machine learning**, the closing scene,  
Unlocking secrets, evergreen,  
In every page, a journey awaits,  
This magazine, wisdom's keepsake.

For the common man, these truths inspire,  
A world of wonder, never to tire,  
From skies above to Earth below,  
These stories touch, connect, and grow.



# Applications

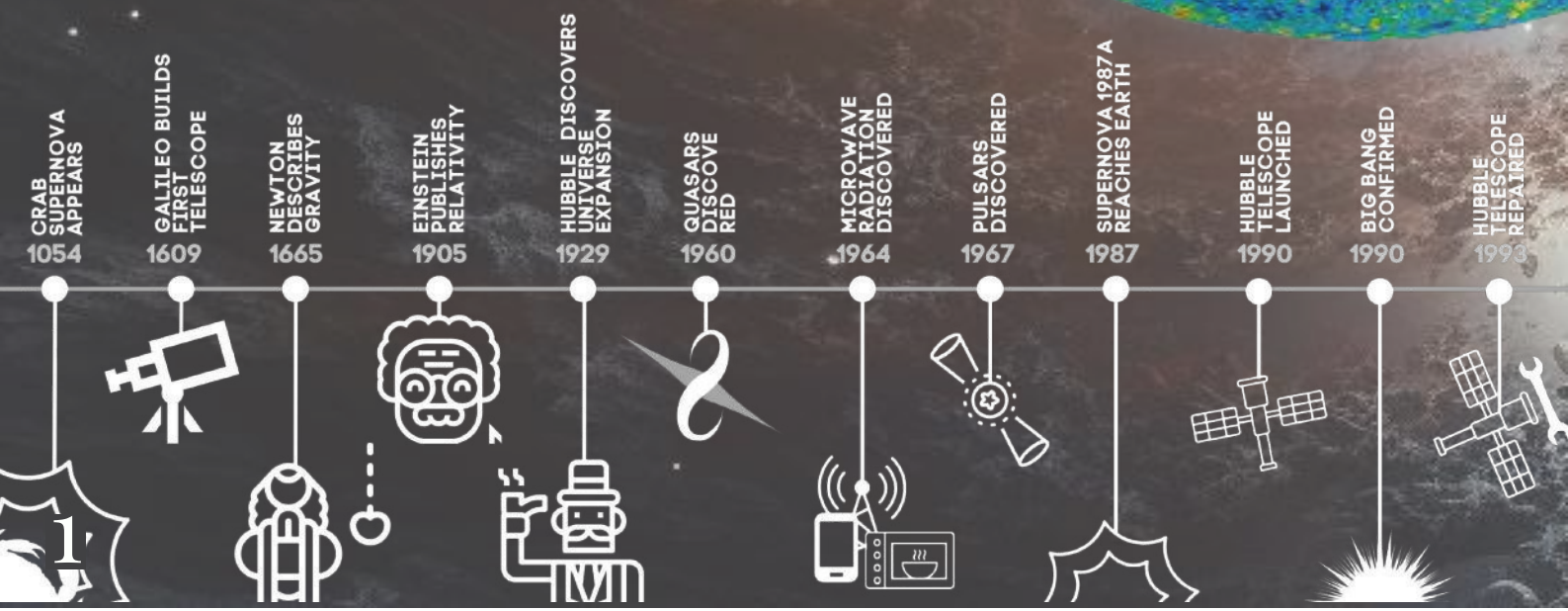
Big Bang Theory explains **how the universe began**.

It helps us understand the **formation of stars, galaxies, and other objects in space**.

The Big Bang Theory inspires future scientists to explore the **mysteries of the universe**.

The theory led to **new technologies for space exploration, and scientific instruments**.

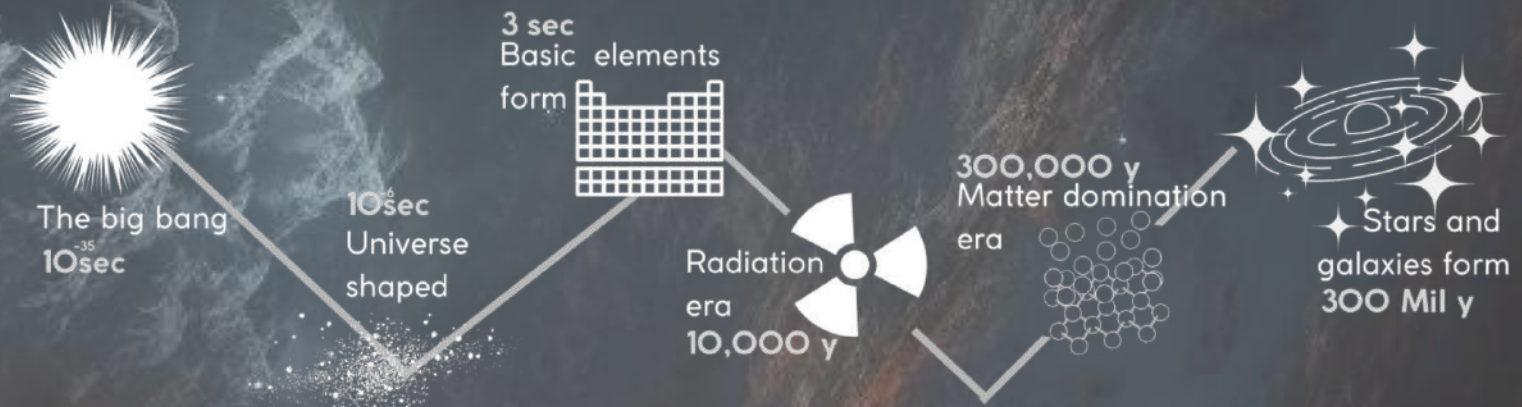
Understanding **matter and energy** leads to developments in **energy and particle physics**.





# The Big Bang

## TIME AFTER THE BIG BANG



Universe origin:  
**a tiny, super-hot, super-dense point, 13+ billion years ago**

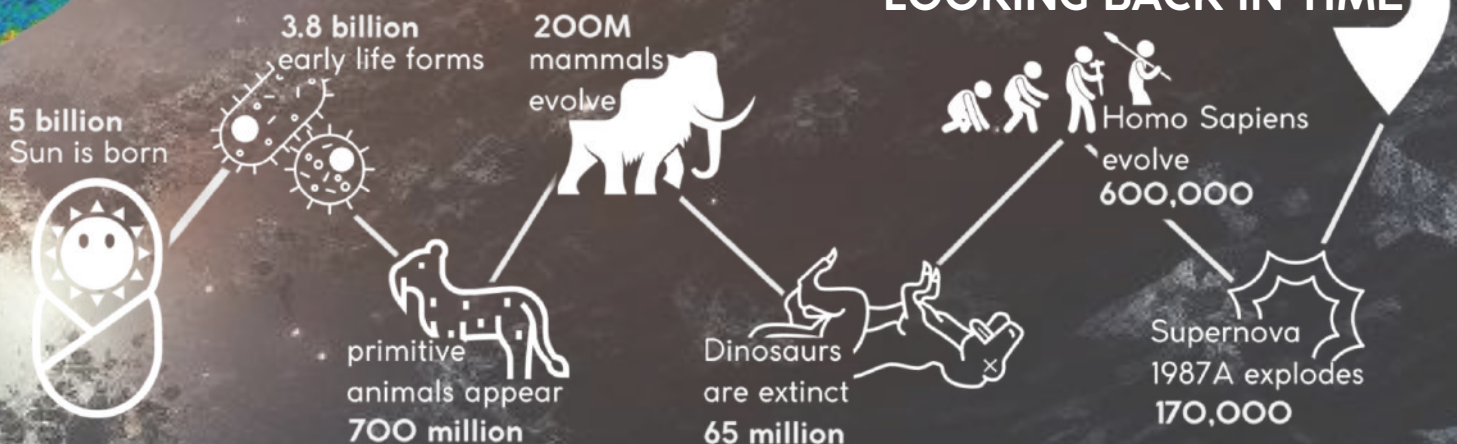
Big Bang:  
**Swift, immense expansion event**

**Sudden burst, dispersing matter and energy**

**Expansion, cooling, and creation of stars, galaxies, planets**

**The universe expands, supported by CMB, Light elements, and Galaxy redshifts**

## LOOKING BACK IN TIME





# Applications

## Black Hole Research

Theory predicted black holes - regions where nothing, not even light can escape due to intense gravity. Studying them helps refine the theory and understand the extreme environments of the universe.



## GPS Technology

GPS devices work by calculating the time it takes for signals to travel from GPS satellites to your device. GPS technology is accurate enough to guide us to our destinations.

## Gravitational Waves

Gravitational waves are ripples in spacetime caused by the collision of massive objects like black holes or neutron stars. They help us to understand the properties of black holes, neutron stars, and the universe itself.



# Relativity

**Covariance:** Physics' laws are universal and motion-independent.

**Spacetime:** interwoven space and time.

**Fourth dimension:** Time.

**Speed of light:** constant in vacuum.

**Gravity:** warping of space.

**Gravitational lensing:** Mass warps space and bends light.

**Time dilation:** gravity is stronger, and time passes more slowly.



# Applications

name: TECTONIC PLATE

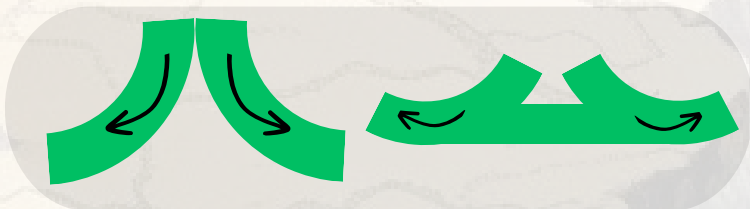
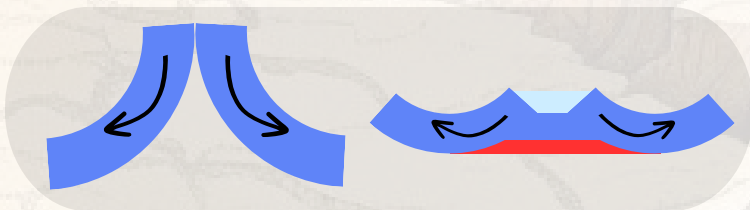
age: APPROX 3.4 Bil Yr

speed: 3-5 Cm/Year 

size: 25km thick avg.

COMPOSED OF THE  
CONTINENTAL AND  
OCEANIC CRUST OR  
LITHOSPHERE.

## DIVERGENT BOUNDARY ▼



## CONVERGENT BOUNDARY ▼



## ISLAND ARCS



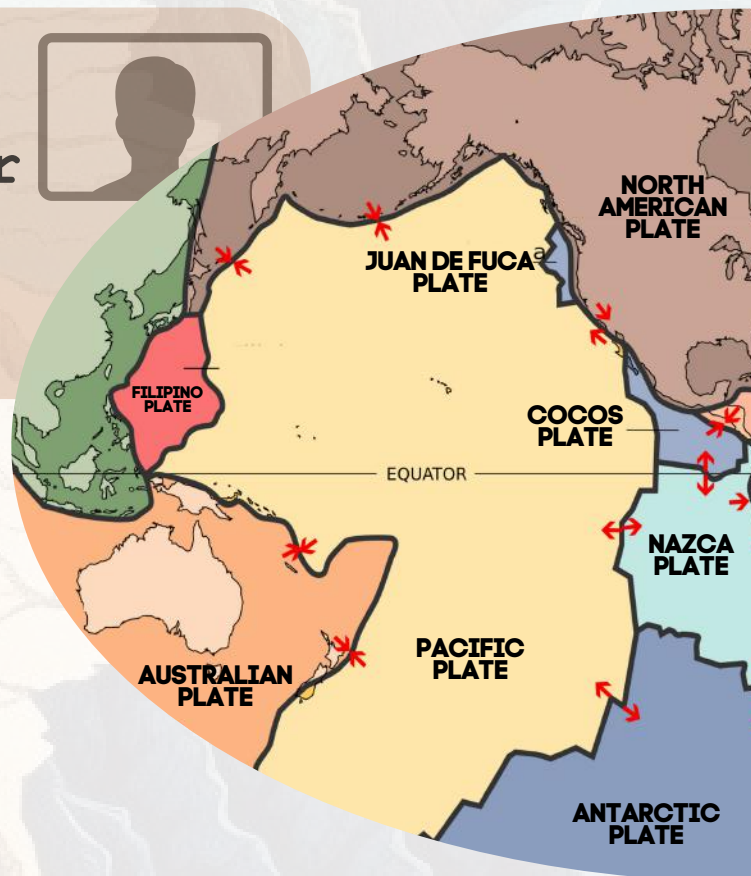
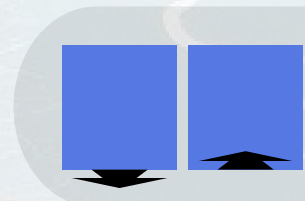
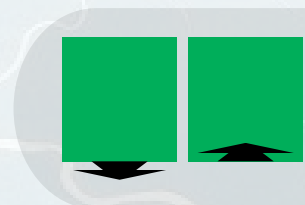
## TRENCHES



## RIDGES



## TRANSFORM BOUNDARY ▶





# Plate Tectonics



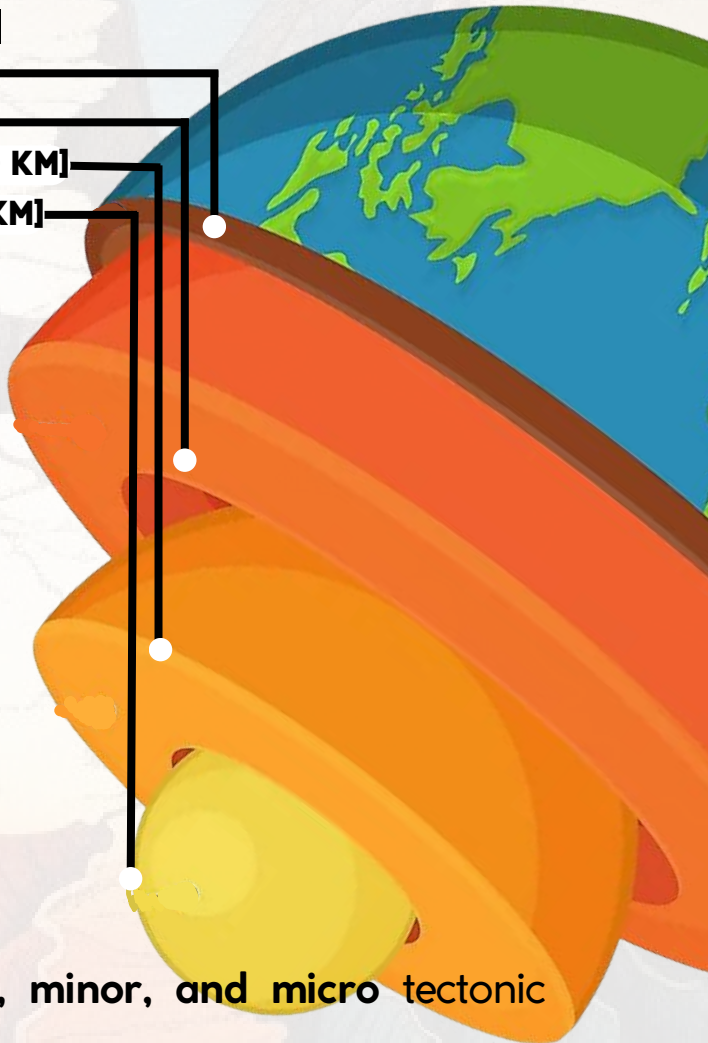
## LAYER THICKNESS

CRUST [8-40 KM]

MANTLE [2900 KM]

OUTER CORE [2250 KM]

INNER CORE [1300KM]



## MOUNTAINS



## FAULTS

There are **major, minor, and micro** tectonic plates.

Tectonic plates are gigantic **pieces of the Earth's crust and uppermost mantle.**

Earth's surface shifts have **sculpted towering mountains and profound oceans.**

Move at an average of **one to two inches (three to five centimetres) per year.**

Major **landforms** were created due to Earth's **subterranean movements.**

Tectonic plate maps reveal locations of **mountains, volcanoes, and earthquakes.**



# Applications

## GENE THERAPY

Treating genetic diseases by correcting or replacing faulty genes with functional ones.



## PHARMACOGENOMICS

Tailored drug treatments using genetics for efficacy and fewer side effects.

## DNA-BASED ANCESTRY TESTING

Tracing an individual's genealogy and ethnic background.

## NUTRIGENOMICS

Genetic-based nutrition plans prevent disease and promote health.





# Gene Theory



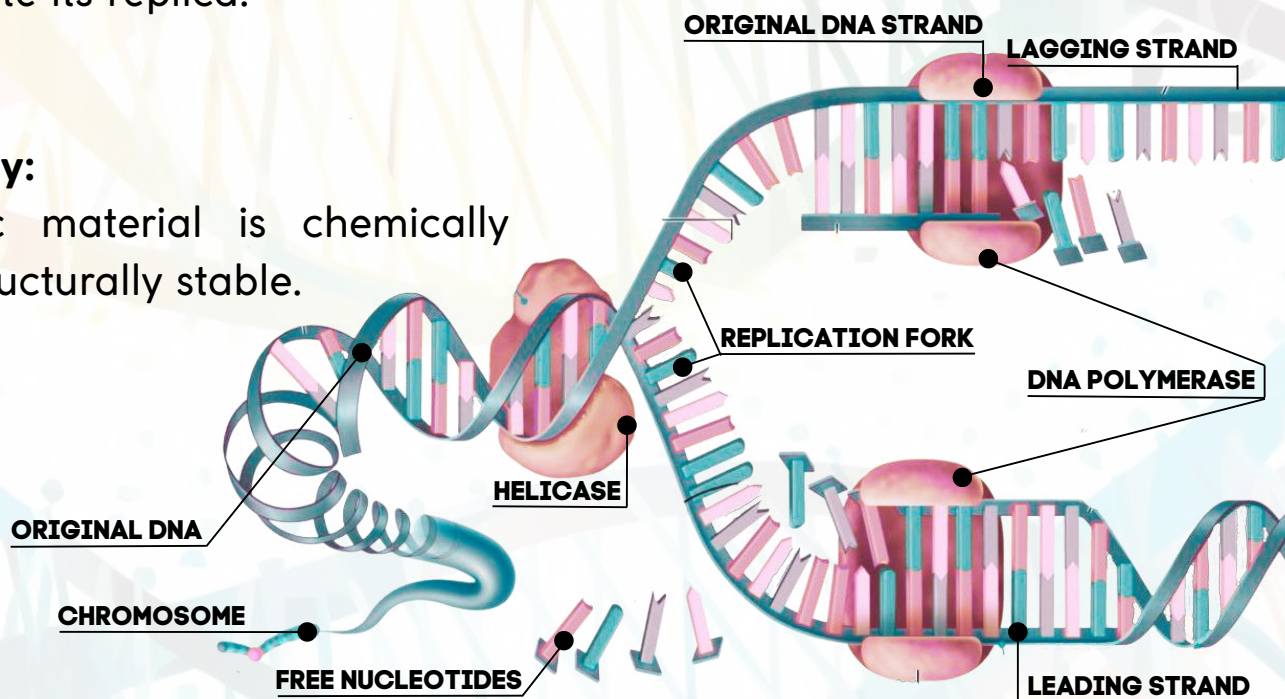
## Replication:

Generate its replica.

It should be present in every cell.

## Stability:

Genetic material is chemically and structurally stable.



## Mutation:

Enable gradual genetic changes for evolution.

## Genetic expression:

Genes show simple traits and store information.



# Applications

# IT FLOWS

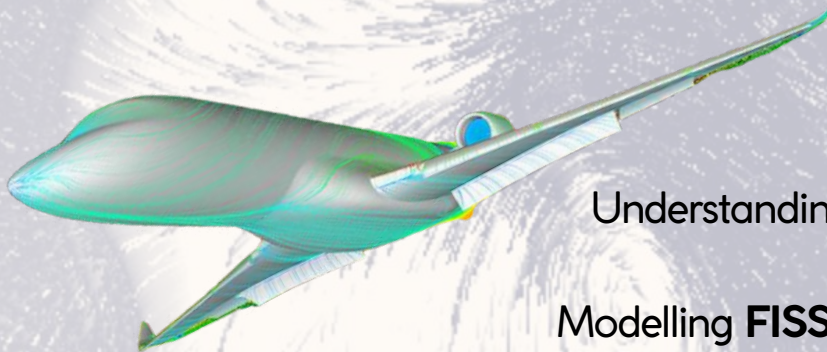
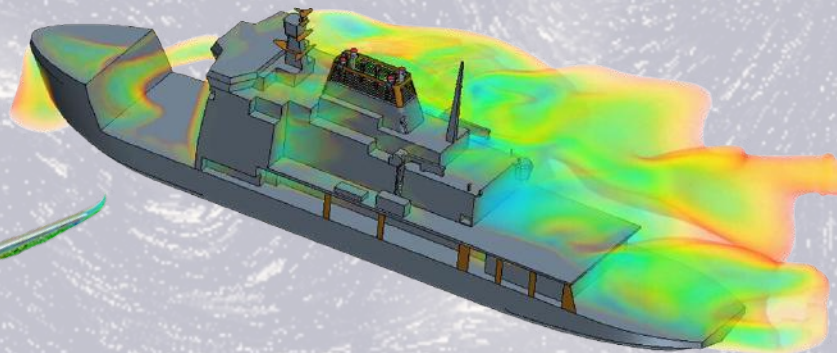
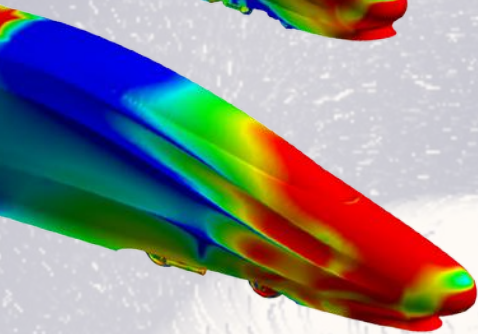
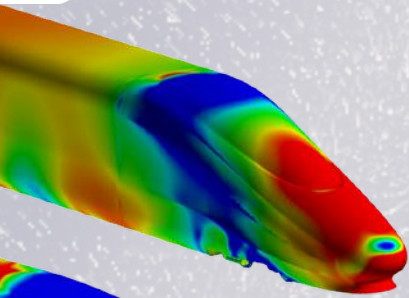


Flow: intrinsic properties of such as compressibility, viscosity, and density.

Calculating **FORCES** and **TURBULENCE** on an aircraft.

Determining the **MASS FLOW RATE** of petroleum through pipelines.

Predicting **WEATHER** patterns.



Understanding **NEBULAE** across the universe

Modelling **FISSION WEAPON DETONATION**.

**AIR CONDITIONING** system.

## Other applications



Water flow and Weather



Power Plants



Artificial Hearts





# Fluid Dynamics

**Fluids** are materials with the property to flow or deform under applied shear stress

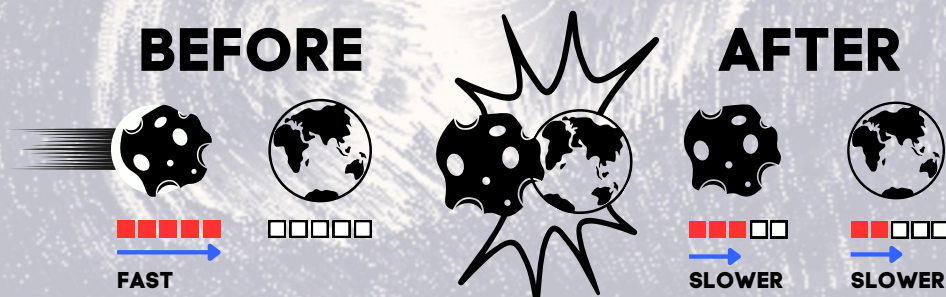
**Liquids** and **gases** are considered fluids.

**Fluid dynamics** is study the motion of liquids, gases, and plasmas.

Fluid Dynamics explains the evolution of **planets**, **ocean tides**, **weather patterns**, **tectonic plates**, and blood circulation in the human body.

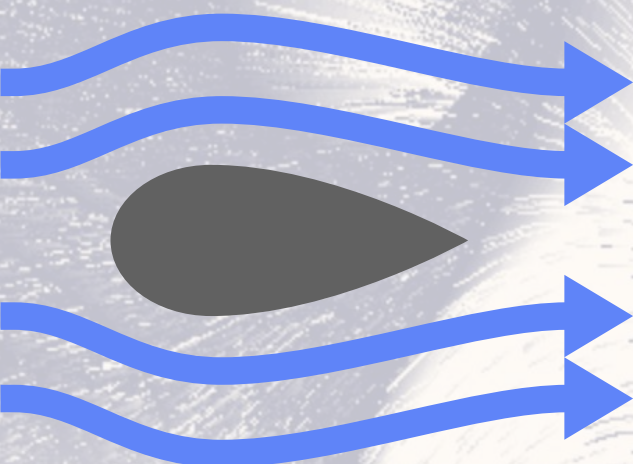
## LAWS IN FLUID DYNAMICS:

Conservation of mass, momentum, and energy.



## LAW OF CONSERVATION OF MOMENTUM

## LAW OF CONSERVATION OF MASS

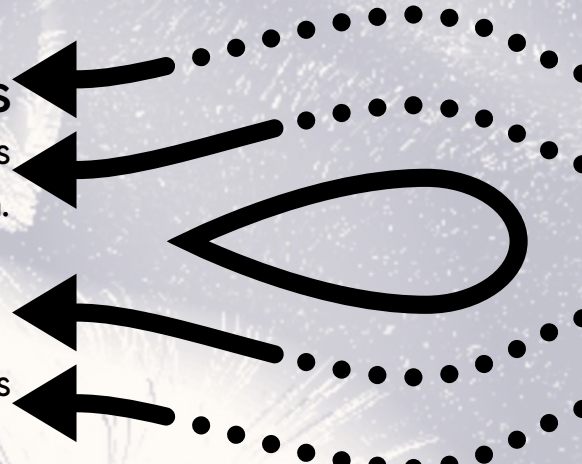


## AERODYNAMICS

Fluid dynamics of gases in motion.

## HYDRODYNAMICS

Fluid dynamics of liquids in motion.

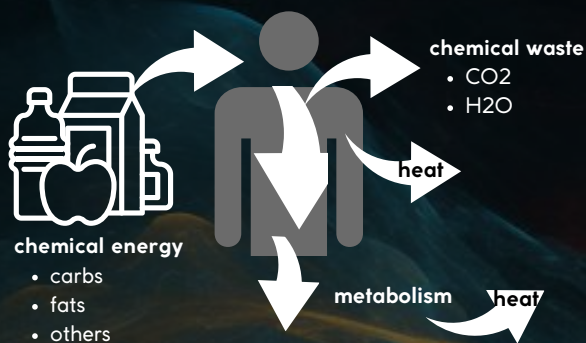
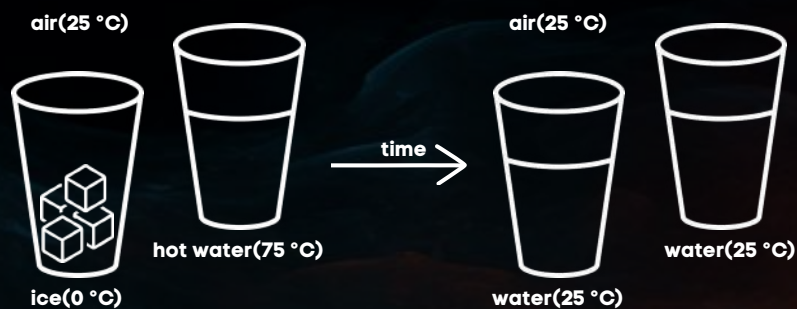




# Applications

## Air conditioners

The air conditioner removes heat from the room and maintains it at a lower temperature by transferring the absorbed heat into the atmosphere.



## Metabolism

Process of converting food into energy. ATP molecules provide energy for various biochemical processes in the body.

## Power plants

Thermodynamics encompasses diverse power plants, from thermal to sustainable sources.





Relations between **heat**, **work**, **temperature**, and **energy**.

# Thermo Dynamics

**Randomness:** The movement of molecules.

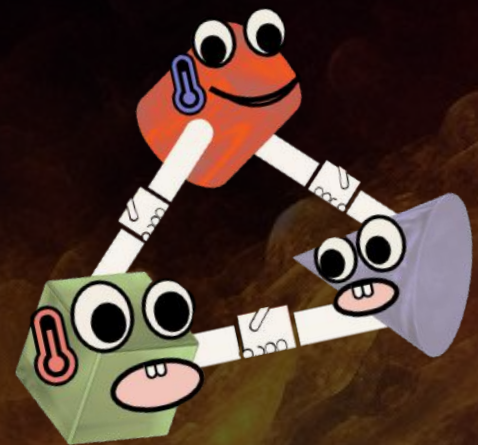
**Entropy:** Degree of disorder or uncertainty in the system.

**Enthalpy:** Total heat contained in the system.



## ZEROTH LAW

If two bodies have thermal equilibrium with some third body, then they are also in thermal equilibrium.



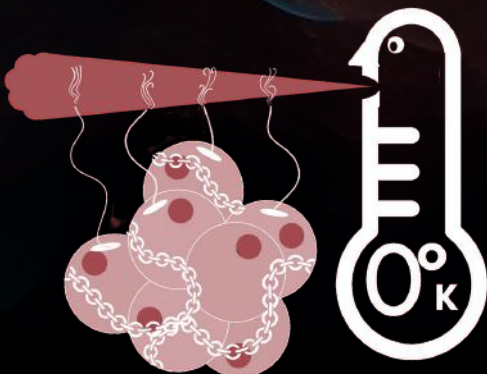
## FIRST LAW

Energy cannot be created/destroyed, only converted/conserved in a system.



## SECOND LAW

The state the entropy of the entire universe, as an isolated system, will always increase over time.



## THIRD LAW

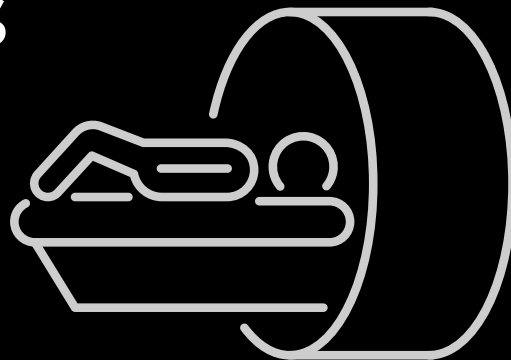
Entropy of a perfect crystal at absolute zero is zero.





# Applications

**MRI scanners** used for medical imaging.



**GPS** uses **atomic clocks** to accurately locate places.

**Lasers** produce focused, powerful beams through the process of **optical amplification and stimulated emission**.

**Quantum internet** employs satellites for advancements.

**Solar panels** convert **sunlight** to **electricity** using quantum mechanics.





# Quantum Mechanics

Discovering the universe through  
**subatomic exploration.**

Quantum ties **defy distance**  
**limitations.**

Quantum **superposition of**  
**multiple states.**

**Heisenberg's Principle-**  
Uncertainty in the position &  
momentum of a particle.

**Wave-particle duality of**  
matter.





# Applications

## High power transmission lines:

The superconducting cables permit high power transmission without power loss.

Making of Supercomputers

Magnetically levitating the world's fastest trains.

In the medical industry as part of **Superconducting Quantum Interferometers (SQUIDS)**.

## Particle Accelerators:

Special coiled materials create strong magnetic fields to help speed up tiny particles in large machines.

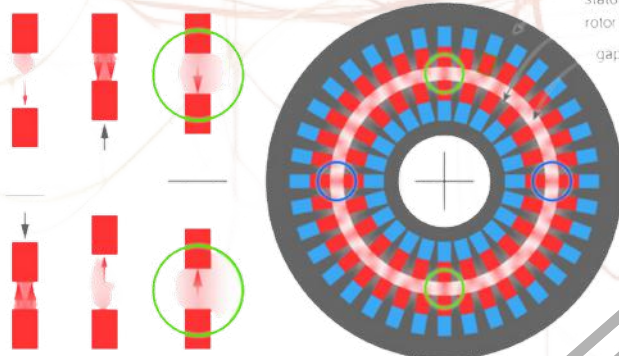
Superconducting claw pole motors.

MRI diagnosis

## Bearings:

The Meissner effect is made use of in the bearings.

Generation and transmission of electric power.



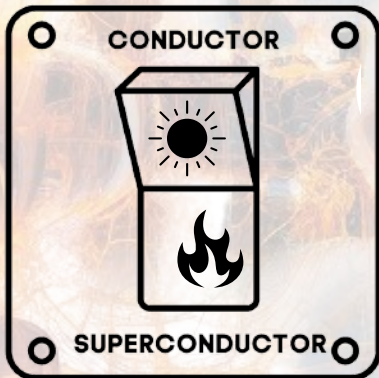


# Super Conductivity



Materials conducting DC electricity with **nearly zero** resistance.

Materials require **ultra-low temperatures.**



Zero resistance/infinite conductivity: Superconducting materials exhibit **no resistance** below the critical temperature (e.g., Hg  $< 4$  K).



**Magnetic field expulsion:**

Superconductors below critical temperature, exhibit the

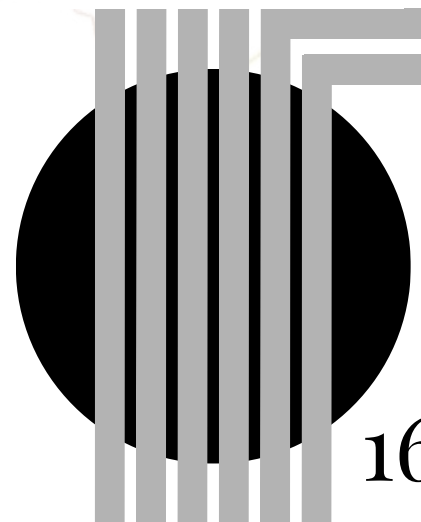
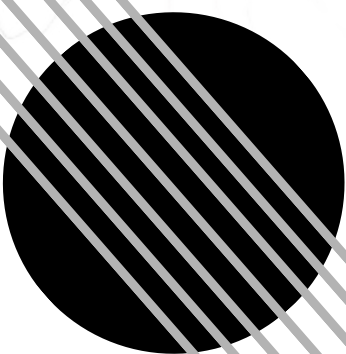
**Meissner Effect**, preventing magnetic field penetration.

**Transition temperature:**

Swift change from conductors to superconductors at a set temperature.

**Critical Magnetic Field:**

The critical magnetic field is the threshold for superconductivity and is temperature dependent.





# Applications

## STOCK MARKET:

Predict investors' actions and their effects on stock prices.



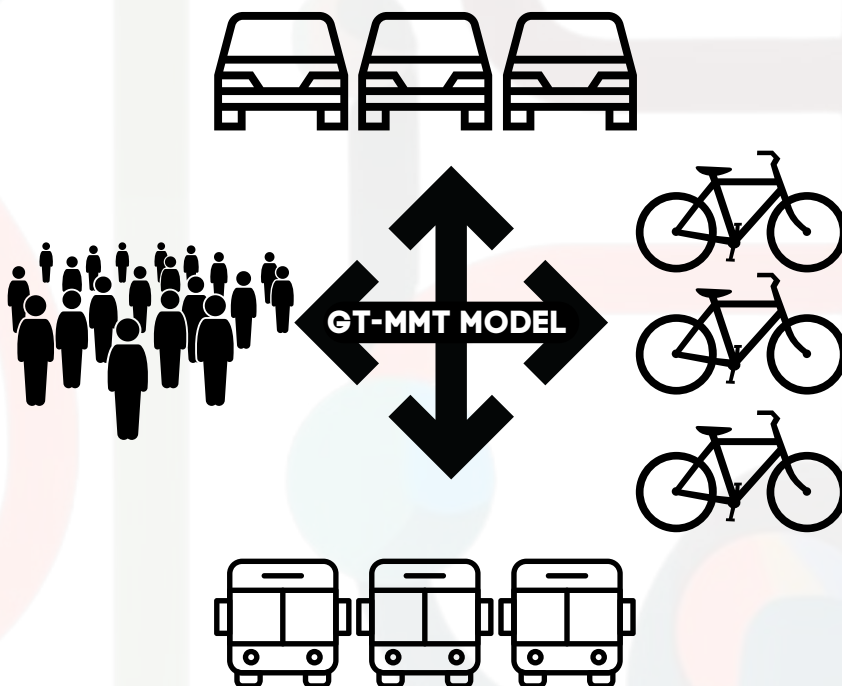
## RESOURCE ALLOCATION:

Helps balance choices for efficient use of time and money.



## MARKETING AND ADVERTISING:

Analyze competitors to create stand-out, successful strategies.



## GROUP PROJECTS AND TEAMWORK:

Encourage co-operation and fair input from everyone for better results.

## MILITARY STRATEGY:

Consider all factors for improvement.



# Game Theory

## Game:

A situation involving two or more players who have to **make decisions** that affect each other's outcomes.

## Player:

Analyzes interactive decision-making situations.

## Strategy:

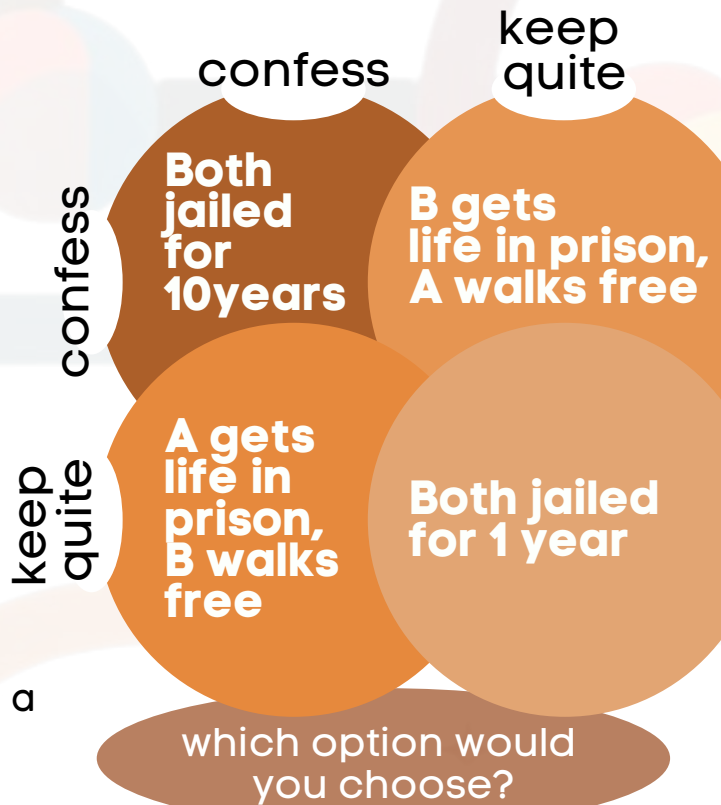
Player's action plan for the desired outcome in the game.

## Payoff:

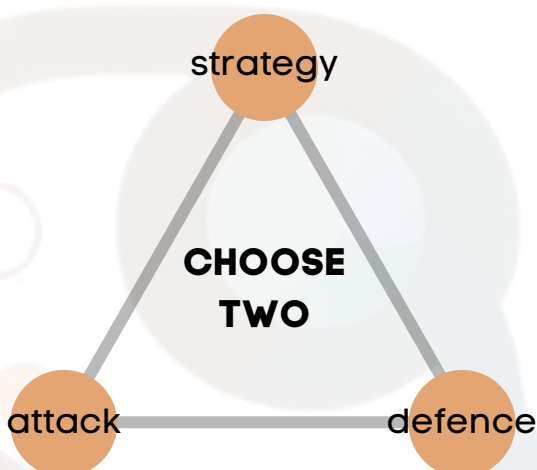
The result of players' strategies in a game.

## PRISONER B

## PRISONER A



## HOW PEOPLE THINK CHESS IS



## HOW CHESS REALLY IS



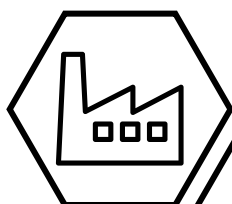
## Dominant Strategy:

Best strategy despite opponents.

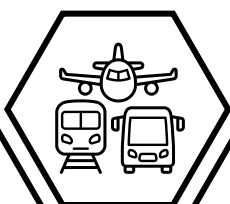


# Applications

## MANUFACTURING



## TRANSPORTATION



## INSURANCE



## AUTOMOBILE



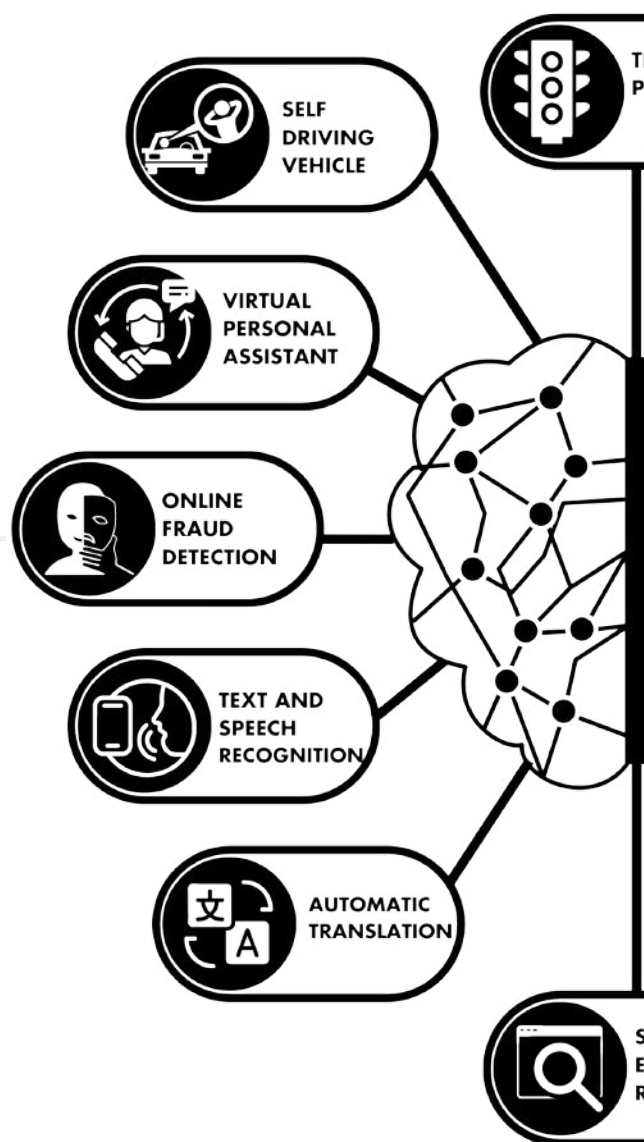
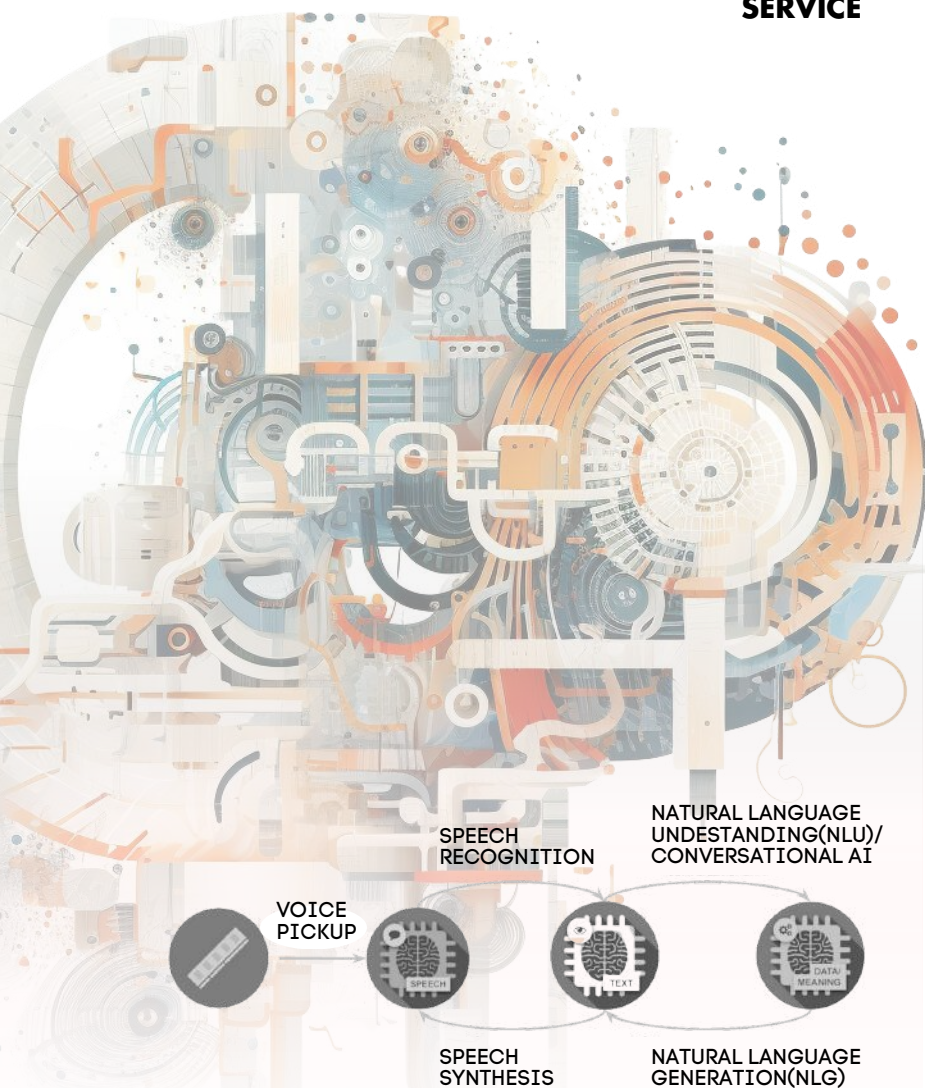
## E-COMMERCE



## CUSTOMER SERVICE



## HEALTHCARE

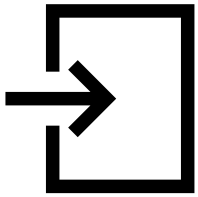




# Machine Learning

Machine learning is like **teaching a computer** to learn from examples.

1



It **recognizes pictures, makes predictions, and creates new things.**

2



3



4



5



The computer **finds patterns** by looking at **lots of examples.**

TRAFFIC  
PREDICTION



STOCK  
MARKET  
TRADING



IMAGE  
RECOGNITION



MEDICAL  
DIAGNOSIS



EMAIL SPAM  
FILTERING



PRODUCT  
RECOMMENDATION

SEARCH  
ENGINE  
RESULTS

There are **three main types** of machine learning.

**Supervised:** when the computer is given labelled data, like having a teacher.

**Unsupervised:** when the computer finds patterns in data without being told, like exploring on your own.

**Reinforcement:** when the computer learns through trial and error, like playing a game to learn.



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