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Supralight Quantum Tension: An Analysis in Black Holes and Transonic Flights

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Brief Introduction

The idea of this mathematical analysis is to make a comparison between different bases of three disciplines: aerodynamics of flight at high speeds, curvature in black holes and structure of magnetic fields. This book aims to build a programming model of mathematical variables at a structural level, bringing together an interdisciplinary academic body that combines these three branches of physics: electrical physics, flight aerodynamics and the technical-mathematical branch of black holes. .

The purpose is to integrate the theory of shock waves caused by the speed of an aircraft within the context of a black hole, also exploring the possibility of frequencies that travel at hyperluminal speeds. This interdisciplinary approach will allow a deep analysis of how the interactions between these phenomena can be modeled and simulated, providing a more complete and advanced understanding of them.

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Purpose of Analysis

The purpose of this analysis is to investigate and model the interactions between high-speed aircraft, black holes and magnetic fields from an interdisciplinary perspective. Specifically, this study seeks:

1. **Integrate Concepts of Aerodynamics and General Relativity**:

   Explore how the principles of high-speed aerodynamics behave in the presence of the intense curvature of space-time near a black hole.

   Analyze the effects of shock waves and aerodynamic flows in extreme relativistic contexts. The main idea is to understand the context of how a possible aircraft at superluminal speeds in a very special case would interact with the curvature tensors of a black hole if it had no mass but dimensions made of frequencies.

2. **Modeling the Interaction of Magnetic Fields with Aerodynamic Flows and Black Holes**:

   Develop models that describe how magnetic fields interact with high-speed flows and the extreme curvature of space-time. Investigate the impact of these magnetic fields on the dynamics of aircraft and the structure of black holes.

3. **Explore the Possibility of Superluminal Frequencies**:

   Examine theories and models that allow for the existence of frequencies that can travel faster than light in certain contexts or additional dimensions.

   Evaluate how these phenomena can be detected and modeled, and what implications they have for our understanding of the universe.

4. **Develop Computational Tools and Methods**:

   Implement mathematical models and numerical simulations using Python and MATLAB to study the complex interactions between aircraft, black holes and magnetic fields and also provide a set of tools and practical examples that can be used by researchers and students to explore these phenomena in more depth.

Documentation structure

The book is organized as follows:

1. **Introduction:** Presents the purpose, importance and structure of the book.
2. **Fundamentals of High Speed Aerodynamics:** Covers the basic principles and relevant phenomena in aerodynamics.
3. **Curvature and Dynamics of Black Holes:** Introduces general relativity and its application in the study of black holes.
4. **Interaction Between Aircraft and Black Holes:** Explore the combined effects of aerodynamics and the curvature of space-time.

1.2 Interdisciplinary Importance

Interdisciplinary research, which combines concepts and techniques from various areas of knowledge, is crucial to address complex problems and explore new frontiers in science and technology. In the context of this book, the combination of high-speed aerodynamics, general relativity, and magnetic field theory is of particular importance for several reasons:

1.2.1 Innovation and Advancement of Knowledge

- **New Perspectives**: The integration of different disciplines allows the emergence of new perspectives and approaches to solve problems that could not be adequately addressed from a single discipline.
- **Unexpected Discoveries**: By combining concepts from different fields, it is possible to discover phenomena and relationships that would not be evident if they were studied separately. This can lead to significant advances in our understanding of fundamental and applied physics.

1.2.2 Complex Problem Solving

- **Multidimensional Problems**: Many problems in science and engineering are inherently multidimensional and require an understanding of how different forces and effects interact. For example, the behavior of an aircraft at extreme speeds depends not only on aerodynamics, but also on relativistic and magnetic effects that could influence its stability and performance.
- **Realistic Simulations**: Modeling complex systems such as black holes and their interaction with magnetic fields and aerodynamic shock waves requires advanced tools that can incorporate multiple physical effects in a coherent manner.

1.2.3 Practical and Technological Applications

- **Improvement in Aerospace Technology**: Understanding how high-speed flows and magnetic fields interact in a relativistic context can lead to improvements in the design and operation of aircraft and spacecraft, making safer and more efficient missions possible.
- **Development of New Technologies**: Insights derived from this interdisciplinary approach can inspire the development of new technologies in areas such as space propulsion, communication in extreme environments, and the exploration of hostile astrophysical environments.

1.2.4 Philosophical and Scientific Implications

- **Exploration of the Fundamental Laws**: By investigating how different physical phenomena interact under extreme conditions, we can test and refine our fundamental theories, such as general relativity and quantum field theory.
- **Additional Dimensions and Hypothetical Phenomena**: Consideration of superluminal frequencies and additional dimensions, even if not supported by current experimental evidence, opens the door to speculation and research into the ultimate nature of the universe and the existence of phenomena beyond the standard model.

1.2.5 Education and Training

- **Fostering Collaboration**: Fostering an interdisciplinary mindset in education and research helps produce scientists and engineers who are able to collaborate and communicate ideas across different fields of knowledge.
- **Knowledge Enrichment**: Training in multiple disciplines provides researchers and students with a broader and more versatile set of skills and knowledge, better preparing us to face the scientific and technological challenges of the future.

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Conclusion

The interdisciplinary importance of this analysis lies in its ability to unify and expand our knowledge through the integration of concepts from high-speed aerodynamics, general relativity, and magnetic field theory. This convergence of disciplines not only drives scientific and technological advancement, but also offers new tools and perspectives to address complex problems more effectively and creatively.

2. Fundamentals of High Speed Aerodynamics

2.1 Basic Principles of Aerodynamics

High-speed aerodynamics focuses on the study of the behavior of objects moving rapidly through the air, such as supersonic aircraft and missiles. As the speed of an object approaches or exceeds the speed of sound, unique phenomena are observed that do not occur at subsonic speeds. The basic principles include:

Compressible Flow: At high speeds, the compressibility of air becomes significant, affecting the density and pressure of the flow around the object.

Mach number: It is the relationship between the speed of the object and the speed of sound in the medium. It is used to classify flight regimes: subsonic (Mach < 1), transonic (Mach ≈ 1), supersonic (Mach > 1), and hypersonic (Mach > 5).

Shock Waves: They are discontinuities in the flow that occur when the object exceeds the speed of sound, resulting in abrupt changes in pressure, temperature and density of the air.

Prandtl-Glauert effect: Describes the intensification of pressure on the surface of the object as it approaches the speed of sound, creating an increase in aerodynamic drag.

Modified Bernoulli's Law: At high speeds, Bernoulli's law is adjusted to account for the compressibility of the flow, allowing analysis of the pressure distribution in the moving object.

Wave Drag: A component of aerodynamic drag that becomes significant at transonic and supersonic speeds, caused by the formation of shock waves.

Conclusion: These basic principles are fundamental to design and analyze aircraft and other objects that operate at high speeds, ensuring efficiency and stability in extreme conditions.

2.2 Shock Waves and Compressibility

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Fluids: Since air is a fluid and air is also the object of study of aerodynamics,

It is convenient to establish some basic properties of fluids. Fluid is a body whose molecular arrangement is such that small forces are enough to change the relative position of these moving particles. Liquids and gases are fluids and demonstrate their molecular property of fluids by changing shape easily. ”Fluids change their molecular shape, the structures of their particles”

Steady regime or laminar flow: It is one in which at any point in the fluid, the velocity vector remains constant. This means that at any point in the fluid, the particles that pass through that point have the same speed, direction and direction.

Example: To calculate the maximum clean lift coefficient;

- W is the weight of the aircraft.
- P is the density of air.
- (V)stall is the stall speed.
- S is the reference area.

Software to do flap calculations:

```
import numpy as np
import matplotlib.pyplot as plt

# Data provided
W_max = 12500 # Maximum allowable takeoff weight in kg
fuel_consumed = 1200 # Fuel consumed in kg
rho = 1.225 # Air density in kg/m^3
S = 28.15 # Reference area in m^2
g = 9.81 # Acceleration due to gravity in m/s^2
CL_max_extended_flaps = 1.90 # Maximum lift coefficient with fully
extended flaps
CL_max_flaps_refolded = 0.5 # Maximum lift coefficient
```

Types of aircraft wing profiles (definitions)

1.Wing chord: It is a straight line that joins the forward end of an aircraft wing or leading edge to the trailing edge or trailing edge.

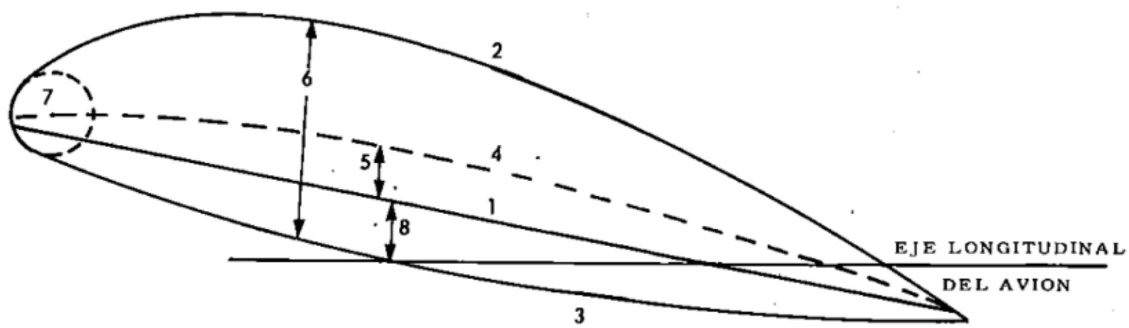
2.Upper curvature: Curvature or semicircle that joins the forward leading edge of the wing and the rear end on the straight line of flight.

3.Bottom curvature: Continuation of the line of the upper curvature below the chord.

6.Maximum thickness: Maximum distance between the upper and lower curvatures.

7.Leading edge radius: Radius of curvature or a geometric circle

8.Angle of incidence: Angle formed by the middle chord and the length or longitudinal axis of an aircraft.



The average chord of an aircraft wing corresponds to the section of the central profile, this means that a distance is established between the ends of the wing, ends of a wing [P+ and P-]

The relative wind, according to Bernoulli's aerodynamic interpretation, lift or the principle of lift will be created every time there is relative movement between the wing and the air.
(This happens when the air, the wing or both move simultaneously)

Relations with tensors: By relating high-speed aerodynamics to the theory of relativity and tensors in the context of a black hole, we can consider how airflow and Bernoulli's principles would be modified in a curved spacetime. General relativity tells us that the presence of a black hole curves space-time, and this effect can alter the behavior of airflow and lift in a hypothetical aircraft moving near the black hole.

Steps to follow to establish aerodynamic relationships with the theory of relativity and tensors in the context of a black hole:

Explanation

1. **Physical Constants and Wing Parameters:** The physical constants and wing parameters necessary for aerodynamic calculations are defined.
2. **Relativistic Correction Factor:** The Schwarzschild radius of the black hole is calculated and used to adjust the air speed based on the gravitational factor. This simulates how the curvature of spacetime affects air speed.
3. **Corrected Lift:** Using the Bernoulli equation, the lift force corrected for relativistic effects is calculated.
4. **Display:** The results are printed and the metric Schwarzschild tensor is displayed in 4 dimensions.

Software code with the necessary steps to calculate the process of physical constants and parameters of the wing:

```
% Physical constants
G = 6.67430e-11; % Gravitational constant in m^3 kg^-1 s^-2
M = 1.989e30; % Mass in kg (mass of the sun)
c = 3e8; % Speed of light in m/s

% Wing and wind parameters
rho_air = 1.225; % Air density in kg/m^3
v_air = 340; % Air speed in m/s (speed of sound)
area_wing = 10; % Wing area in m^2
lift_coefficient = 1.2; % Lift coefficient

% Radius of interest from the black hole
r = 1e7; % Radius in meters (distance from the black hole)

% Calculate the relativistic correction factor
schwarzschild_radius = 2 * G * M / c^2; % Radio de Schwarzschild
gravitational_factor = sqrt(1 - schwarzschild_radius / r);

% Calculate the air speed adjusted by the gravitational factor
v_air_corrected = v_air * gravitational_factor;

% Visualize the metric Schwarzschild tensor in 4 dimensions
syms t r theta phi
g = diag([-(1 - schwarzschild_radius / r), (1 - schwarzschild_radius /
r)^(-1), r^2, r^2 * sin(theta)^2]);
disp('Tensor métrico de Schwarzschild (4D):');
disp(g);
```

The boundary layer upon contact with an aircraft:

Because air is not an ideal flow and has viscosity, it resists flowing when it comes into contact with a surface. Particles that are very close to a surface such as the surface of an airplane wing gradually slow down their speed until they reach zero. Air particles that come into contact with aircraft wing surfaces could gradually slow down in different ways. In order to understand this effect of the boundary layer, high velocities and shock waves we must try to draw dimensions with a cube and try to imagine how the air flow is filtered through our geometric figure or cube. And that there are particles that we cannot see that are passing through a cube and that are part of another dimension.

Three-dimensional: We will represent a three-dimensional cube in which we will simulate the air flow at different speeds. The air speed will be reduced near the walls of the cube to simulate the boundary layer effect.

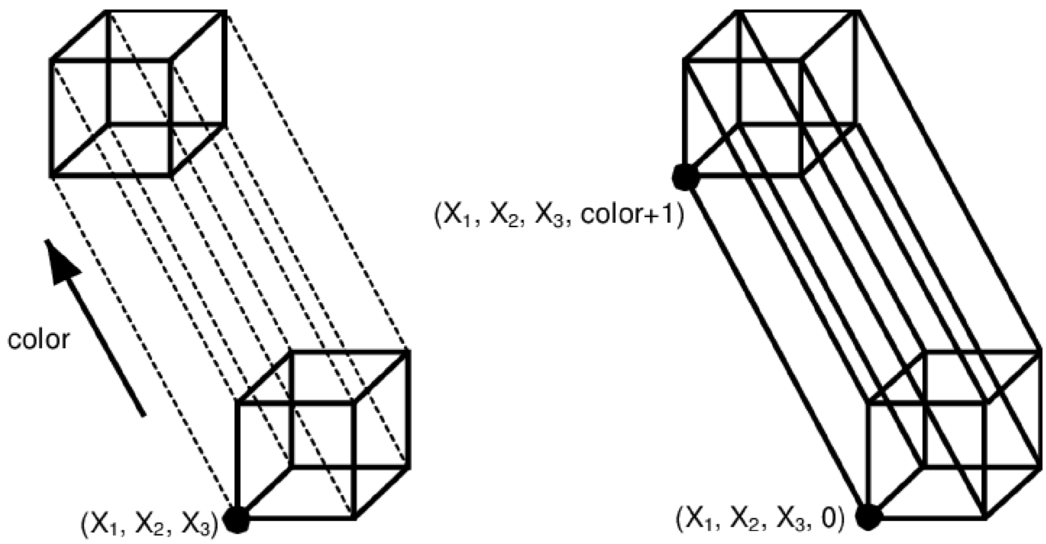
We will proceed as follows:

1. **Define the cube and its dimensions**.
2. **Simulate airflow in the cube**.
3. **Include the effect of the boundary layer near the walls of the cube**.
4. **Visualize airflow and boundary layer effect**.

```
% Hub and airflow parameters L = 1; % Cube length n = 20; % Number of points
in each dimension

% Airflow velocity at center of hub (no boundary layer effect) v_air = 340; %
Air speed in m/s

% cube vertices ver = [0 0 0; 1 0 0; 1 1 0; 0 1 0; 0 0 1; 1 0 1; 1 1 1; 0 1
1]; view = view .* repmat(X,8,1) + repmat(Y,8,1);
```



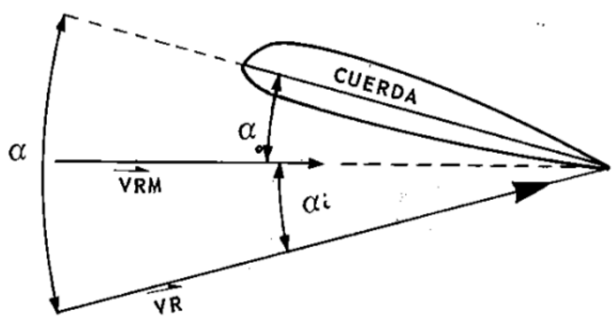
Above these particles, others experience a lesser retardation, until finally at a
At a certain distance from the surface, the speed of the particles is the same as that of the air flow. Let's think about this on a three-dimensional level with a cube or a sphere, it is easier to imagine how air passes through a cube with a certain speed x or y.

The layer or stratum of air that suffers slowing of the speed of its particles at a local level,
Due to the effects of the viscosity of the air, this is called the boundary layer that is created when the particles of the air flow come into contact with the wing and fuselage of an aircraft.

The boundary layer has a set of dimensions, layers that come into contact with the air in the atmosphere when we see an airplane flying in the sky. The surface can be sheet-like, laminar, have several layers of viscous flow, layers of air where particles move.

Use: At high angles of attack of aircraft flight, the boundary layer stops and tends to recede. Once this recoil stops the boundary layer with its air sublayers at the level of dimensional structure, the air flow finally separates from the surface of the airplane wing, producing what is called stall.

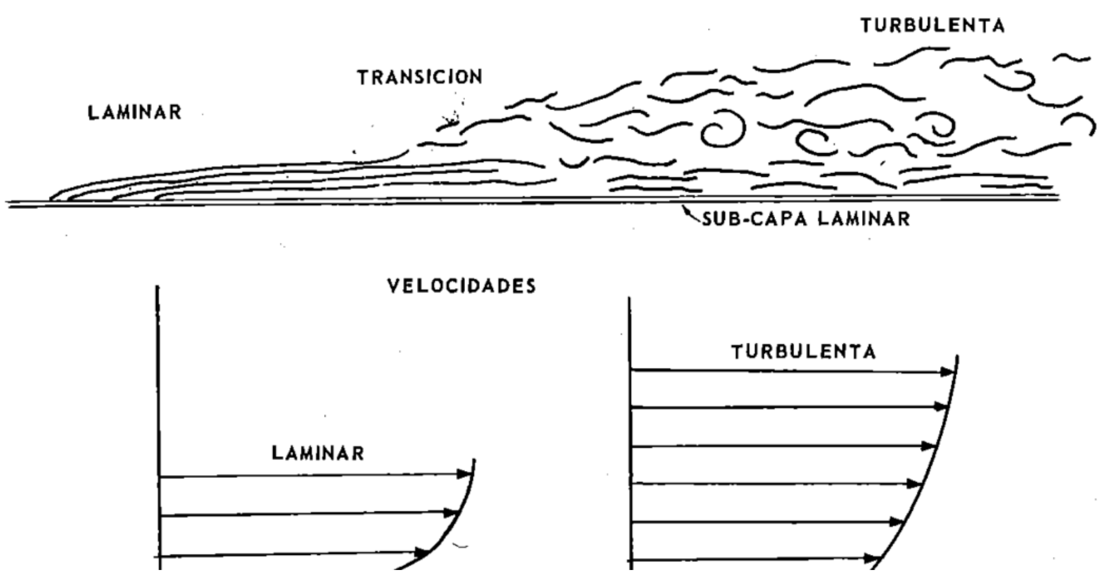
$\alpha = \alpha_0 + \alpha_i$



2. 3 Flights at high speeds (Supersonic aerodynamics)

The speed of sound or sonic velocity is the speed of propagation when the air changes
Its pressure or the particles in the air flow change their pressure level and speed when they collide with a wing. The speed of propagation is very fast and it is not about flying faster than sound, but about the speed of propagation in the air and the fact that the pressure is disturbed. There is disturbance of the pressure effect when flying at high speeds.

The speed of an object compared to the speed of sound, or the speed at which small pulses of pressure are transmitted in the airflow around the aircraft wing, is important to parameterize, or write a parameter of, the supersonic airflow.



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Variables: Given the important variables or indices of the speed of sound, adiabatic coefficient, constants and Temperature:

- "a" is the speed of sound.
- "γ\gamma" is the adiabatic coefficient (for air, γ=1.4\gamma = 1.4γ=1.4).
- "R" is the ideal gas constant (for air, R=287 J/(kg) R = 287 {J/(kg·K)} "R=287J/(kg)"
- "T" is the absolute temperature in Kelvin.

Height	Temperature	speed of sound	MPH Kts

```
% Parameters
gamma = 1.4;          % Adiabatic coefficient for air
R = 287;              % Ideal gas constant for air in J/(kg·K)
T = 300;              % Temperature in Kelvin (example: 300K)

% Calculate the speed of sound
a = sqrt(gamma * R * T);

% Show the result
fprintf('The speed of sound is %.2f m/s\n', a);
```

a = squareRoot % R T

Code Explanation

1. **Parameter Definition**: The values of γ\gammaγ, R and T are defined. In this example, T has been set to 300 K, which is a typical temperature for air at sea level.
2. **Calculation of the Speed of Sound**: The formula a=γRTa = \sqrt{\gamma R T}a=γRT is used to calculate the speed of sound.
3. **Show the result**: The result is printed using `fprintf`.

What is intended in these pages is to carry out an analysis and comparison between the concept of shock waves, laminar flow, laminar layers and the concept of high-dimensional combinatorics in the three-dimensional model of a cube or other type of geometric dimensions. Subsequently, the Riemann tensors of black holes and quantum cryptography will help us to provide a structural analysis model of a possible super quantum structure that acts as an invisible force in high-dimensional systems, analyzing this point with black holes, binary stars and radiation. along with a small computational model with software concepts and quantum cryptography.

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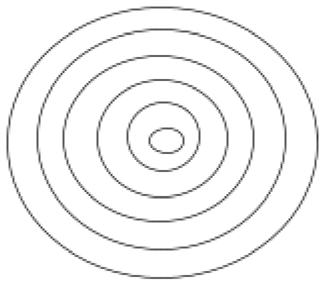
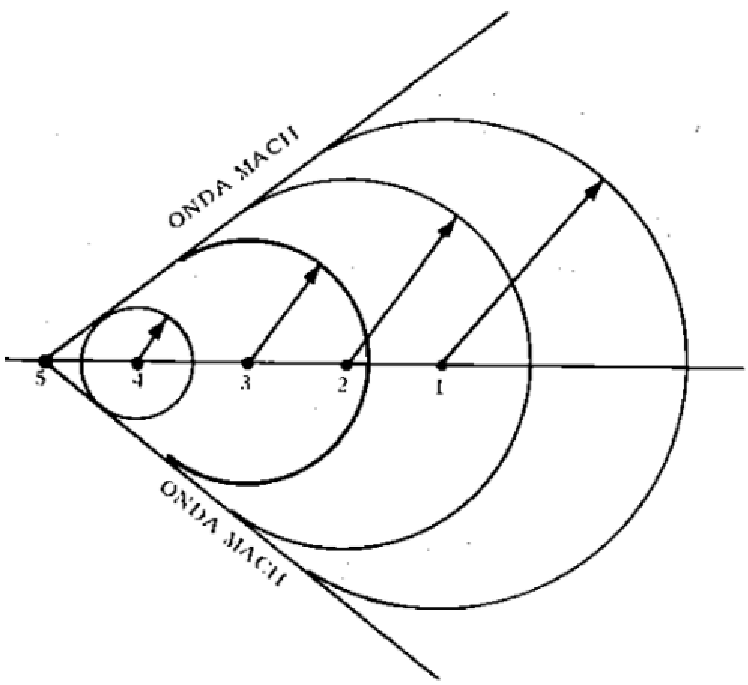
Disturbances from supersonic flights and speeds of sound are transmitted
In spherical shape where the wave front is spherical in shape with concentric circles.



1. These waves move away from an object at the speed of sound. In the assumed case that a particle is moving to the left at a subsonic speed. The particle moves further away from the perturbations that go towards a range (R+, R-)

2. The wave disturbances that appear in the case of an airplane at subsonic speeds appear because there are pressure disturbances that are emitted at the leading edge of an airplane wing.



The variables are the pressure wave and the air flow that begins to rise to come into contact with the wing of the plane.

Spherical Disturbances: Representation of pressure waves as concentric spheres that move away from the object (airplane) at the speed of sound.
Particle in Motion: Show a particle moving at subsonic speed and how it moves away from disturbances.
Pressure Waves and Air Flow: Visualize pressure disturbances and airflow around an airplane wing.

```
import numpy as np
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D

# Parameters
c = 343 # Speed of sound in m/s
time = np.linspace(0, 0.01, 50) # Time interval in seconds
R = c * time # Radius of spherical perturbations
V_particle = 0.5 * c # Particle velocity (subsonic)
particle_position = V_particle * time # Particle position

# Create a 3D figure and axes
fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')

# Draw the concentric spheres representing the pressure waves
for r in R:
    u, v = np.mgrid[0:2*np.pi:20j, 0:np.pi:10j]
    x = r * np.cos(u) * np.sin(v)
    y = r * np.sin(u) * np.sin(v)
    z = r * np.cos(v)
    ax.plot_wireframe(x, y, z, color='b', alpha=0.2)

# Draw the path of the particle
ax.plot(particle_position, np.zeros_like(particle_position),
np.zeros_like(particle_position), color='r', label='Partícula')
```

In turn, a straight line tangent to the waves appears that is perpendicular to the direction of the particle, it is defined as *MATCH WAVE or MATCH LINE*. The air pressure and its speed and direction when a match wave appears remains unchanged.

The Match Wave is a very weak shock wave but at the level of layers and speeds it shows the sheets and dimensions through which speeds travel that are of interest for the analysis of curvature tensors of geometric spaces in black holes.

Brief Analysis of Transonic Flight Type

Transonic flight involves speeds close to the speed of sound, where aerodynamic effects change significantly. Airfoils in transonic flight are important to minimize drag and avoid phenomena such as shock waves.

We can analyze a typical airfoil, such as NACA 0012, which is widely used in aeronautical applications.

```
import numpy as np
from pytornado import TransonicAerofoil

# Definition of NACA profile 0012
airfoil = TransonicAerofoil("NACA0012")

# Definition of flight speeds (subsonic, transonic, supersonic)
mach_numbers = np.linspace(0.7, 1.3, 50)

# Calculation of aerodynamic properties as a function of speed
for mach in mach_numbers:
    airfoil.set_velocity(mach)
    airfoil.solve()

    print(f"Mach Number: {mach}")
    print(f"Lift Coefficient: {airfoil.lift_coefficient}")
    print(f"Drag Coefficient: {airfoil.drag_coefficient}")
    print(f"Pressure Coefficient: {airfoil.pressure_coefficient}")
    print("")
```

Aircraft flaps in approximate calculations:

Stall speed with flaps fully extended and retracted is calculated and displayed, and will also plot the relationship between lift coefficient and stall speed. You can run this code in a Python environment to get the results and visualization. On the other hand, variables are a way to synthesize calculations with programming languages and processes at an automatic or automated level of variables where the aerodynamic variables are:

1. W is the weight of the aircraft.
2. Weigh the density of the air.
3. Vstall is the stall speed.
4. S is the reference area.

```
# Data provided W_max = 12500
# Maximum takeoff weight allowed in kg fuel consumed = 1200

# Fuel consumed in kg rho = 1.225

# Air density in kg/m^3 S = 28.15
# Reference area in m^2 g = 9.81 # Acceleration due to gravity in m/s^2 CL
max flaps extended = 1.90 # Maximum lift coefficient with flaps fully extended
CL max flaps retracted = 0.5

# Maximum lift coefficient with flaps retracted
# Function to calculate stall speed def calculate lost speed(W, fuel, rho,
CL_max, S): W_current = W - fuel lost speed = np.sqrt((2 * W_current * g) /
(rho * CL_max * S)) return lost speed

# We calculate the stall speed with the flaps fully extended lost speed
flaps extended = calculate lost speed(Wmax, 0, rho, CL max flaps extended,
Sprint("Stall speed with flaps fully extended:", round(lost speed flaps
extended, 2), "m/s")

# We calculate the stall speed with the flaps retracted lost speed flaps
retracted = calculate lost speed(W Max, fuel consumed, rho, CL max flaps
retracted, Sprint("Stall speed with flaps retracted:", round(lost speed flaps
retracted, 2), "m/s" )
```

Types of supersonic flows also appear at a three-dimensional or 3D level, defined as follows:

Flows: Air particles do not have a static viscosity at a point, they are usually forced through three-dimensional 3D approximations to abruptly change their direction to flow parallel to certain types of surfaces of the wings of an airplane. Here we would be defining the well-known compression waves or oblique shock waves, which is a wave that moves at supersonic speed.

1. Angulo Match
2. Line Match
3. Sonic Speed and Speed of the wing plate to be measured

$$\boxed{\text{Sin } n = \text{Sonic V / Plate V} = a/V = 1/(v/a) = 1/M}$$

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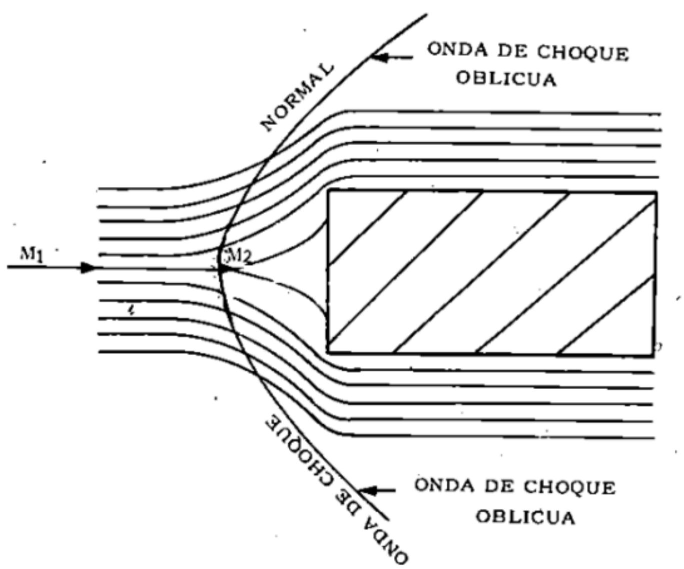
Mach wave description (reflections)

- There is a region of influence on the surface of an airplane wing plate where the match wave appears and here supersonic flow analyzes and three-dimensional flow analyzes produced by a particle can be established. It is interesting to note that these speeds are close to a comparative concept which is that of superluminal speeds or speeds of light in a vacuum that could be established in the type of context where a black hole is.

- Analyze the effects of shock waves and aerodynamic flows in extreme relativistic contexts with types of radiation that are not exactly “light” but rather a type of frequencies that are inverted at a level of structures of opposite dimensions or in another plane different from what we consider light. and photons traveling at a certain speed in a vacuum and generate combinatorics of very high dimensions that are practically imperceptible and could be homologous to a small radio frequency of an antenna.

Normal shock waves: The normal shock wave is a compression wave that is stronger than oblique waves and forms a 90-degree angle to the relative wind.



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Transonic flight of the aircraft:

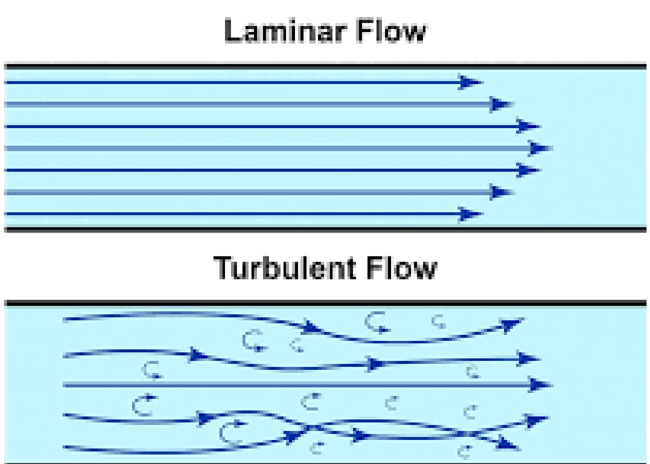
Transonic flight refers to the speed regime in which the aircraft's speed is close to the speed of sound, approximately between Mach 0.8 and Mach 1.2. During transonic flight, interesting phenomena can be observed such as the formation of shock waves and the variation in the pressure distribution around the aircraft wing.

Below is a simplified version of transonic flight of an aircraft, focusing on the visualization of shock waves and pressure distribution around the wing using Python.

Key Concepts

1. **Mach Number**: It is the relationship between the speed of the aircraft and the speed of sound.
2. **Shock Waves**: They form when the aircraft reaches transonic speeds, causing a discontinuity in the pressure and temperature of the airflow.

Critical mach number: When studying the production of lift in an antisymmetric wing, at subsonic speeds, it can be observed that the air that collides or affects directly on the wing, that flow to which we are referring, accelerates at higher speeds than in the bottom of the wing of the plane and that in the free flow of influence of the plane.



Parameter Definition:

- `V` is the speed of the aircraft, which in this case is approximately the speed of sound.
- `a` It is the speed of sound.
- `mach_number` calculates the Mach number of the aircraft.

Pressure Distribution:

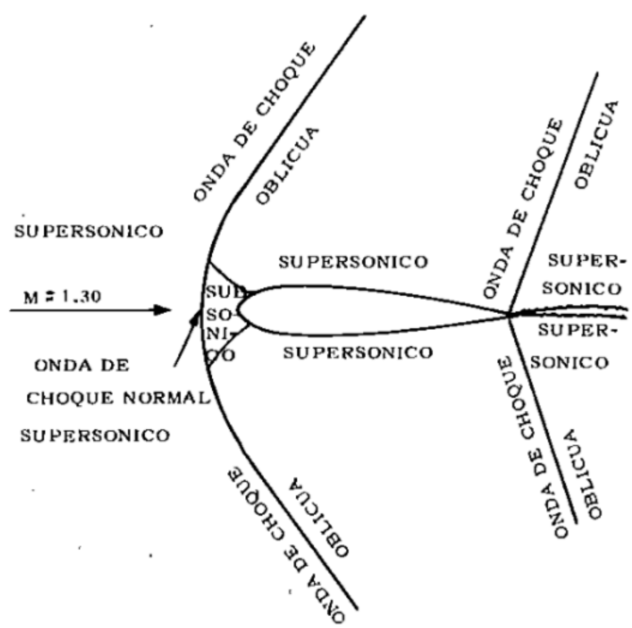
- `x` and `and` They define the grid on which the pressure distribution will be calculated.
- `pressure` is a simplification of the pressure distribution around the wing.

Shock Wave Effect:

- `shock_wave` simulates a shock wave at the edge of the wing.

Display:

- It is used `contourf` to create a filled contour map of the pressure distribution and shock waves.
- `plt.axhline` and `plt.axvline` They add lines to highlight the position of the wing and the shock wave.
- `plt.legend` adds a legend for the shock wave.



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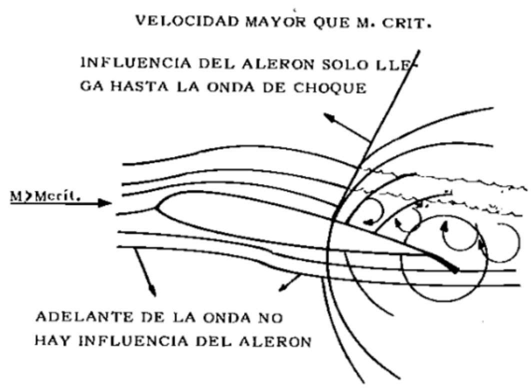
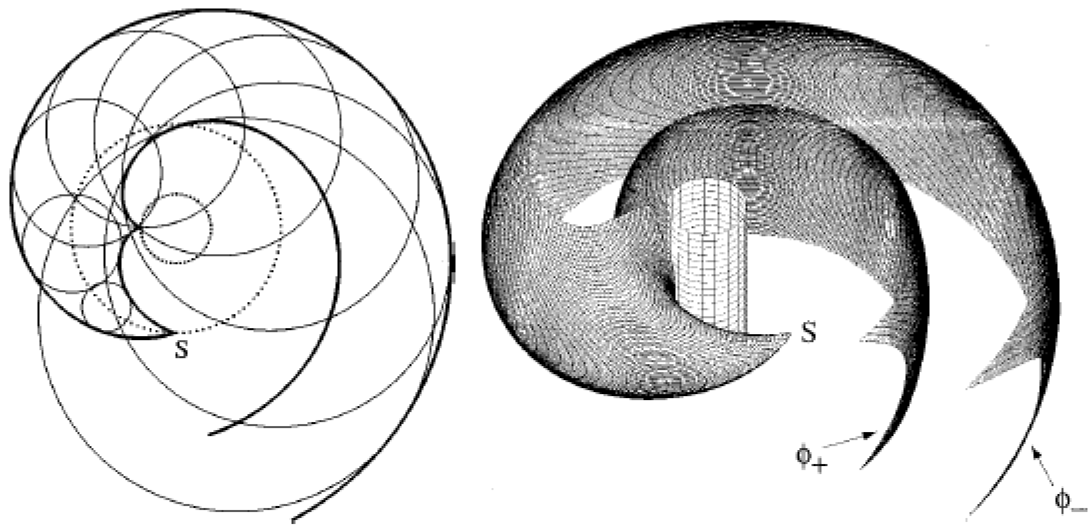
1. Problems with transonic flights include decreased aerodynamic characteristics of the wing (increased drag and decreased lift)
2. Pounding

3. Loss of effectiveness of flight controls and instability
4. Sonic barrier problems.

5. The pressure waves transmitted by the deflection of the aileron: The variables are the highest speed, M>Mcrit, the influence wave and the shock wave.



Shock waves and superluminal pulsars in theories about black holes:
The vibrations or hums that the pilot perceives in the control stick are an indication to Let him slow down. The pilot has a prior warning that announces the knocking and vibrations that are produced by aircraft turbulence. Particles of a different quantum type than the one known do not consist of a defined mass and it is possible that their dimensions consist of a property of transposition (D) at very high speeds and that a possible aircraft could be composed of supraluminal quantum particles (tachyons). or qubits (Aircraft) or something similar, comparing this concept or idea with the curvature of tensors of Rienmann black holes and the theory of Cherenkov Radiation, new patterns could be established within the framework of theoretical physics for black holes. But here it is necessary to carry out an analysis of the structure of frequencies, tensors and Cherenkov radiation.



3. Curvature and Dynamics of Black Holes

3.1 Introduction to General Relativity

The theory of general relativity, proposed by Albert Einstein in 1915, revolutionized our understanding of space, time and gravity. Unlike Newton's theory of gravitation, which describes gravity as a force acting at a distance, general relativity interprets gravity as a manifestation of the curvature of space-time. This curvature is caused by the presence of mass and energy.

3.1.1 What is a Tensor?

To understand general relativity, it is essential to become familiar with tensors, which are fundamental mathematical tools in this theory. A tensor generalizes the concepts of scalars and vectors to higher dimensions and is used to describe the physical properties of a system at any point in spacetime.

- **Scalar (Rank Tensor 0)**: A quantity that does not change under coordinate transformations, such as the temperature at a point.
- **Vector (Rank Tensor 1)**: A quantity with magnitude and direction, such as speed.
- **Rank 2 Tensor**: A matrix that can describe more complex properties, such as stresses in a material or space-time metrics.

In MATLAB, we can illustrate tensors using multidimensional matrices and arrays. For example, a rank 2 tensor can be represented as a matrix

```
% Example of a rank 2 tensor (a 3x3 matrix)
tensor_rango2 = [1, 2, 3; 4, 5, 6; 7, 8, 9];
disp('Rank Tensor 2:');
disp(tensor_rango2);
```

3.1.2 Space-Time and Metrics

In general relativity, space and time are combined into a single entity called spacetime. The metric is a tensor that describes how distances and time intervals are measured in this curved spacetime. The metric tensor gμνg_{\mu\nu}gμν provides a way to calculate the separation between two events in spacetime.

Introduction to Riemann Geometry and Tensors

1.1 Definition of Tensors

- A tensor is a mathematical object that generalizes the concepts of scalars, vectors and matrices. In the context of general relativity, tensors are fundamental to describing the properties of spacetime.
- A rank 2 tensor in a 4-dimensional space (such as spacetime) can be represented as a 4x4 matrix.

Scalars, points and vectors

In what follows we restrict our attention to the real numbers R and the ordinary geometric space E 3, an affine space of dimension 3 and endowed with the Euclidean metric.

The elements $\alpha \in$ R are called scalars and can be considered as zeroth order tensors. The elements A $\in$ E 3 are called points. The coefficients (v1, v2, v3) are called coordinates of v in the base (e1, e2, e3). A linear map T is called a tensor of order two on a vector space V: V $\rightarrow$ V, so that

In 3 v 7$\rightarrow$ T v $\in$ V.

Engineering, collections

Formula:

$$\boxed{\mathbf{V} = AB = B - A}$$

Tensioner bases:

The set of vectors, together with the vector addition operations using the **parallelogram rule and product by a scalar** has the structure of a vector space, called V, vector space associated with **E3**. On the other hand, the Euclidean vector space V has dimension 3, meaning that a base of 3 linearly independent vectors can be established **(e1, e2, e3)** which allows any vector $v \in V$ to be expressed as a linear combination.

Tensor Curvature

Theory: Tensors, aerodynamics and shock waves are useful to represent physical phenomena of Riemann curvature and represent parameters that help us build and search for new theories about curved spaces that are represented beyond three dimensions and make a comparative, that is, defining the laminar layer of an airplane with the different dimensions of the aircraft and retaining tensors of a black hole to understand possible interactions between frequencies without a predefined mass and geometry that generates a high-dimensional combinatorics within a structure of superluminal aircraft and the curvature of space when using Riemann tensors.

2.1 The Riemann tensor

- The Riemann tensor R^\r{\sigma}Rνρ describes the curvature of space-time. It can be calculated from the metric tensor gμνg_{\mu\nu}gμν.

2.2 Ricci Tensor and Scalar of Curvature

Equality Property: Two tensors $S, T \in V2$ are equal if and only if

$$\mathbf{S} \cdot \mathbf{v} = \mathbf{T} \cdot \mathbf{v} \ \forall \mathbf{v} \in \mathbf{V}.$$

1. The Ricci tensor RμνR{\mu\nu}Rμν is obtained by contracting the Riemann tensor: [Rμν=μρνρ _{\mu\nu}
2. The curvature scalar R is obtained by contracting the Ricci tensor:

The components of a tensor can be written in the form of a matrix,

[S] =

[S11 S12 S13

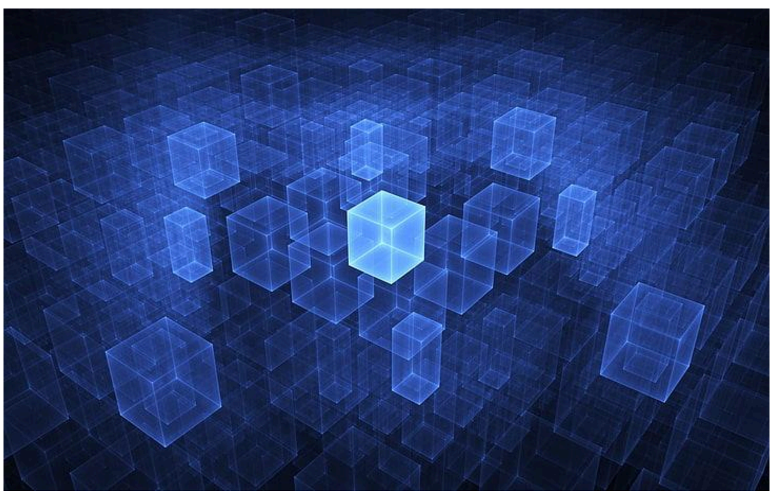
S21 S22 S23

S31 S32 S33]

, (A.15)

This basic analysis in MATLAB provides a way to study the curvature of tensors and the radiation of objects around a black hole. The steps include defining the metric tensor, computing the Christoffel and Riemann tensors, and finally, analyzing the radiation frequencies.

Cubic representation figure of multiple spatial nodes 1.1



```
% Initial parameters
syms m q B E
v = sym('v', [1 4]); % Particle speed

% Radiation frequency calculation
gamma = 1 / sqrt(1 - norm(v)^2 / c^2); % Lorentz Factor
omega = q * B / m; % Cyclotron frequency
omega_synchrotron = gamma^2 * omega; % Synchrotron
frequency
% Frequency display
fplot(omega_synchrotron, [0, 10], 'LineWidth', 2);
xlabel('Time (s)');
ylabel('Frequency (Hz)');
title('Synchrotron Radiation Frequency');
grid on;
```

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The tensor product (also called dyadic) of two vectors a and b is defined as a tensor of order two:

$$(\mathbf{a} \otimes \mathbf{b}) \cdot \mathbf{v} = a(b \cdot v) \ \forall \mathbf{v} \in \mathbf{V}.$$

4. Radiation Frequencies

Radiation from particles in orbit is also considered. The observed frequencies can be calculated using the synchrotron radiation formula and general relativity.

```
% Initial parameters
syms m q B E
v = sym('v', [1 4]); % Particle speed

% Radiation frequency calculation
gamma = 1 / sqrt(1 - norm(v)^2 / c^2); % Lorentz Factor
omega = q * B / m; % Cyclotron frequency
omega_synchrotron = gamma^2 * omega; % Synchrotron frequency

% Frequency display
fplot(omega_synchrotron, [0, 10], 'LineWidth', 2);
xlabel('Time (s)');
ylabel('Frequency (Hz)');
```

```
title('Synchrotron Radiation Frequency');
grid on;
```

Permutations and definition of dimensions as a tensor:

Permutations define how the different dimensions of a tensor or curvature of a very very small part of a black hole change while it could interact with massless or superluminal frequencies:

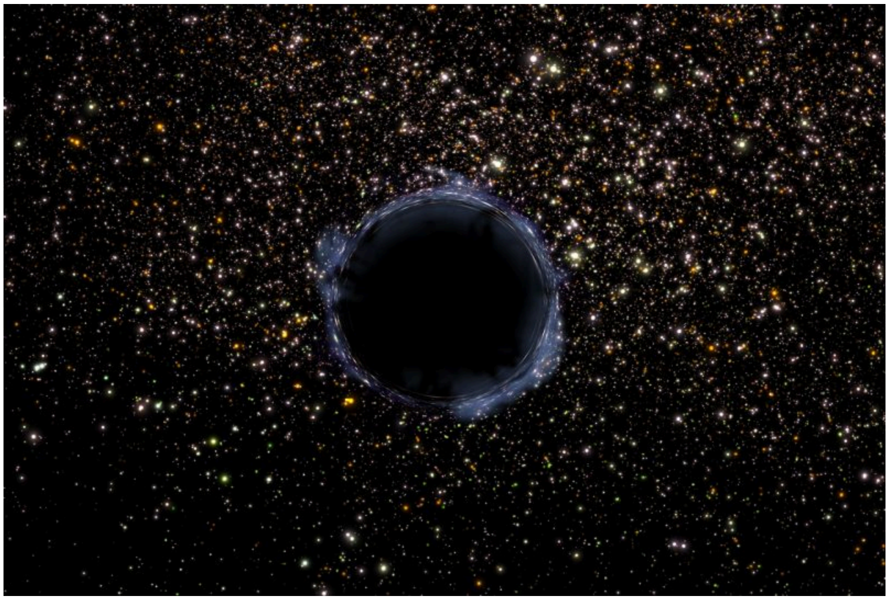
```
Developing the expression, we check that its value is +1, −1 or
0 according to
the case:

iq =
+1 if the permutation (i, j, k) are by:
(1, 2, 3), (2, 3, 1)  ́o (3, 1, 2);
−1 if the permutation (i, j, k) is odd:
(1, 3, 2), (2, 1, 3)  ́o (3, 2, 1);
0 yes in (i, j, k) Some index is repeated.
```

Analogously, the mixed product of three vectors is where different interactions between tensors and spatial dimensions are found:

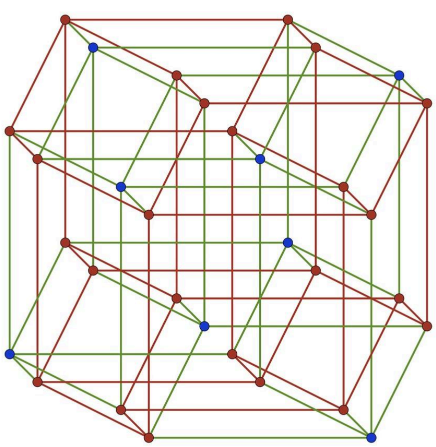
[a, b, c] = (a ∧ b) · c = E(**iq**) A(**iBj**)C(k).

Engineering, collections

1.1 black hole figure



Schwarzschild's Metric Tensor



The metric Schwarzschild tensor describes the geometry of spacetime around a massive spherical object, such as a non-rotating black hole. In spherical coordinates (t,r,θ,ϕ)(t, r, \theta, \phi)(t,r,θ,ϕ), this tensor captures how distances and times are deformed due to the presence of a mass.

Step 1: Define the Variables

First, we define the constants and symbolic variables in MATLAB. These variables include the spherical coordinates (r,θ,ϕ,t)(r, \theta, \phi, t)(r,θ,ϕ,t), the mass MMM, the gravitational constant G, and the speed of light c.

```
% Define constants and symbolic variables
syms r theta phi t M G c
```

These functions accurately represent how the Schwarzschild metric models the geometry of spacetime around a black hole. Each component has a specific effect on how spacetime intervals are measured and reflects fundamental properties of general relativity in the presence of a strong gravitational field such as that of a black hole.

Definition of the parameters to calculate:

```
Definition of Space:

  • x, and, With They define a three-dimensional grid that
    represents the space around a cube.
  • X, AND, WITH They are matrices that represent the
    coordinates of space.

Air Flow Velocity:

  • V is the speed of the air flow.
  • air_density is the density of air.

Pressure Calculation:

  • pressure It is calculated using the simplified Bernoulli
```

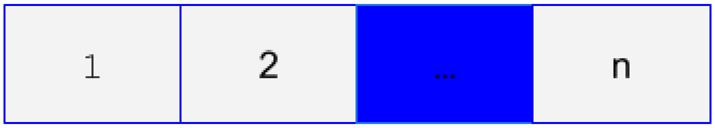
```
     equation.

Display:

  •  quiver3 It is used to visualize the airflow around the
     cube.
```

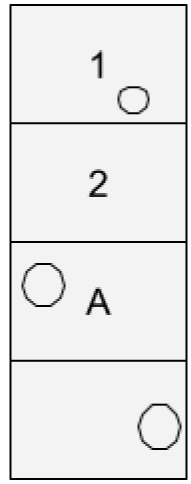
Case Hypothesis: It would be necessary to draw some type of transonic aircraft whose structure had no mass and could travel between the curvature of tensors of a black hole and imagine that certain types of frequencies

They intermingle with the distant curved space of the black hole:

```
import numpy as np
from pytornado import TransonicAerofoil

# Definition of NACA profile 0012
airfoil = TransonicAerofoil("NACA0012")

# Definition of flight speeds (subsonic, transonic, supersonic)
mach_numbers = np.linspace(0.7, 1.3, 50)

# Calculation of aerodynamic properties as a function of speed
for mach in mach_numbers:
    airfoil.set_velocity(mach)
    airfoil.solve()

    print(f"Mach Number: {mach}")
    print(f"Lift Coefficient: {airfoil.lift_coefficient}")
    print(f"Drag Coefficient: {airfoil.drag_coefficient}")
    print(f"Pressure Coefficient: {airfoil.pressure_coefficient}")
    print("")
```

Dimensions of tensioner sets:





Examples of range tensors (0,0) and available range tensors (0,1)

Variables:

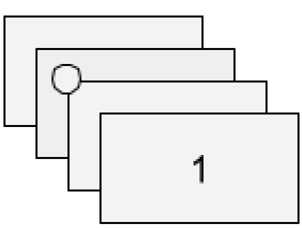
val |=> (λ < λ < λ1) MD

Equation 1.1

$$\frac{dxa}{of}$$

The coordinates are taken as an example before displaying the equations of:

Parameter 1
Parameter 2



There are also scalar functions of a range called G and several transformations of the vector in a simple tensor testing framework:

$$\boxed{(\alpha = 0, \ldots, D - 1)}$$

D being the set of dimensions minus one unit (D - 1) to represent the different points of a number of dimensions in a concept map or mathematical concept map with cubic combinations.

Some of the properties of the tensors where generic structures of quantum superluminal particles are found

1. The cube or geometric spatial shape replicates itself
2. The space and dimensions where superluminal (quantum) particles are found are deformed
3. Superluminal quantum particles transpose
4. Superluminal Quantum Particles Bend and Transform
5. Superluminal quantum particles become detached from their geometric angles
6. They do not have a defined mass or the same structure as a photon.
7. Spatial curvatures are found that are not represented in three dimensions
8. Spaces formed by particles whose behavior is not sequential, with the ability to self-modify at the tensor level
9. Spaces greater than 4 dimensions that are not visible to the eye, extremely small within tensor mathematical sets.

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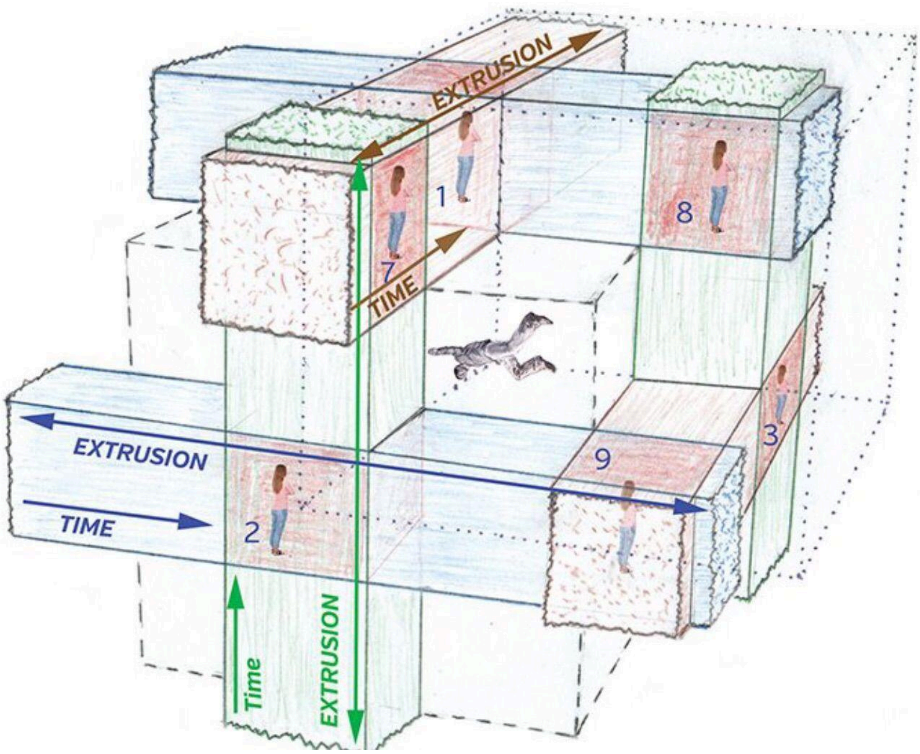
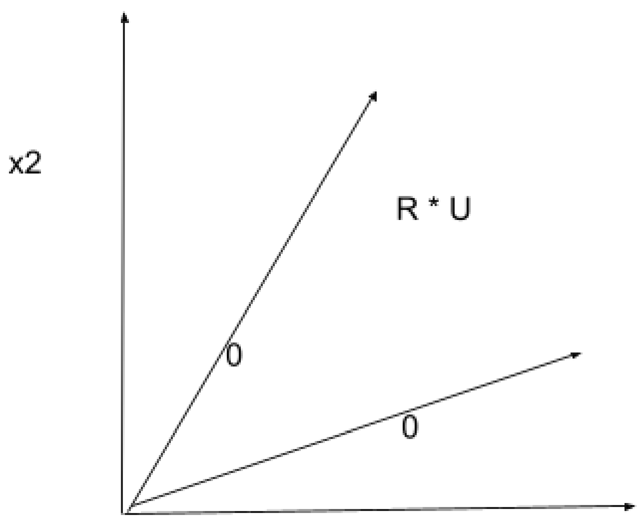
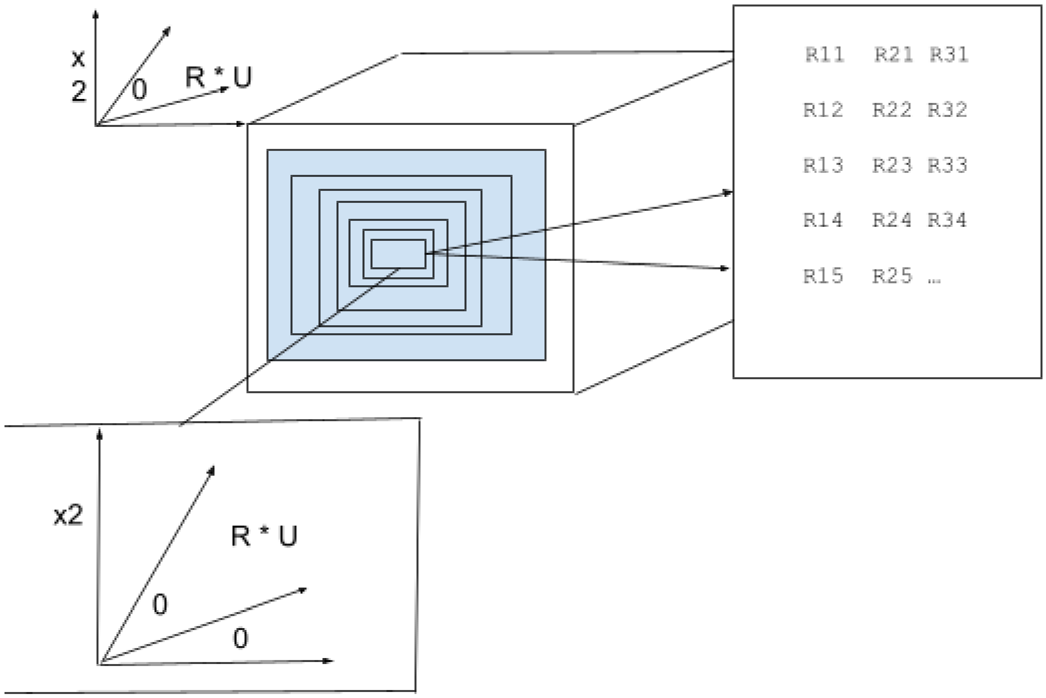




R11	R21	R31
R12	R22	R32
R13	R23	R33
R14	R24	R34
R15	R25	R0
R16	R26	R36
R17	R27	R37

Where R are Dimensions set and transitional states

Engineering, collections



The supraluminal particle is represented in several dimensions and lacks the same structure and properties of a photon, structurally it is similar or bears resemblance to a qubit at a computational level, it is a series of hyper dimensions at a structural level where the particle adheres and It adapts to the set of high dimensions and frequencies of a black hole in magnetic fields or flows of five or more dimensions. These are not actually superluminal speeds, they are extra dimensions that are imperceptible and, although extremely small, they are adaptable to high-dimensional combinatorics and frequencies that cannot be accessed through the instrumentation available on this planet. .

```
Tensioner dimensions:
R11 = c1 * (R * e1) = e1*(cos0 + sen0)= cos0
[R] = (cos0)(-sen0)
      (sen0)(cos0)
```

Properties:

“Light” is not radiated, but supraluminal particles appear to us whose structures belong to a range of curvature or tensors of the black holes themselves or high-dimensional curvatures close to stars or some distant exoplanet in another galaxy.

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Properties of particles and dimensional structures not covered by current physics are close to the analogous properties of quantum particles at a computational level and are encompassed within Riemannian tensors. It is another way of thinking without the classical terms of space and time that restrict the concept of high-dimensional combinatorics and the hyper-dimensional structures of qubits or types of superluminal particles that are computed at levels of research and instrumentation still unknown on the planet. land.

Computational levels of superluminal particles:

The computational or virtualized basis of the curvature and dimensional structures around a black hole or a star are made of tensors, unimaginable spaces that could be defined at supraluminal speeds within the theory of tensors and quantum particles without analyzing effects. of gravity that do not correspond well with the structures or high dimensions of particles that operate virtually. To this end, a structural analysis of quantum particles has been carried out at a computational level and the type of transpositions and adaptive unfoldings involved.

Idea of programming tools (clusters) for subsequent effective analyzes of stars and black holes:

There is a programming and virtual terminal tool called docker swarm where analysis can be performed with up to 1000 interactive network nodes. This allows reliable analysis of the characteristics of stars and dimensions of space study objects.

Determinant of a tensor;

A11 a12 ... a1n

A21 A22 ...

….. ….. ….. …..

An1

An3

An4

Description of the determinant of spatial coordinates and quantum models within the Riemannian tensor bases:

The foundations or bases of the construction of quantum models within the Riemann tensors are found in the matrices, the determinants and the bases of the transposition of supraluminal qubit structures, that is, the bases of quantum computing and the construction of a new model where computational structures are worked on at a quantum level to highlight or modify it within the tensors and curvatures of the conical sections of a possible black hole or star coordinates.

High-dimensional combinatorics studies the phenomena and geometry of dimensions beyond normalized spatial perception and in a mathematical way and with well-constructed mathematical sets. Tensors, quantum cryptography at a structural level and high-speed aerodynamics in the laminar layers of air flows are a good starting point to start building some bases, a quantum model that consists of solid high-dimensional bases and that of response at speeds greater than the speed of light in a hypothetical galaxy or the set of proximities of a star in outer space.

On the other hand, with the support of software programming languages and Docker swarm to analyze multiple nodes at the galactic level we would have fundamental and effective theoretical bases to answer many of the questions about the universe, spatial curvatures and black holes without relying on insistently in the classical theory of general relativity whose bases are found in regions that are not computed at a quantum level and in high-dimensional structures.

Figure of a determinant A.

$$A = \begin{bmatrix} a11 & a12 \\ A21 & a22 \end{bmatrix}$$

$$|A| = a11\ a22 - a12\ a21$$

Superluminal quantum pulsar:

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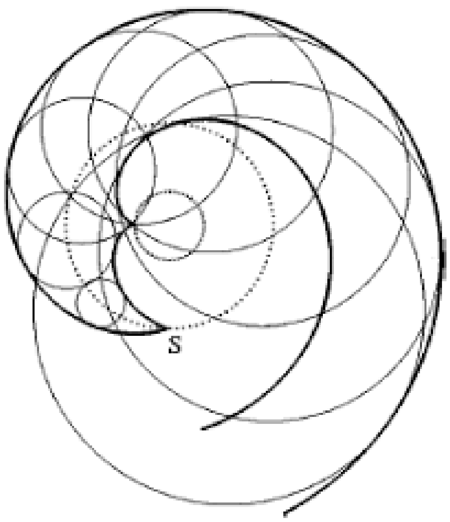
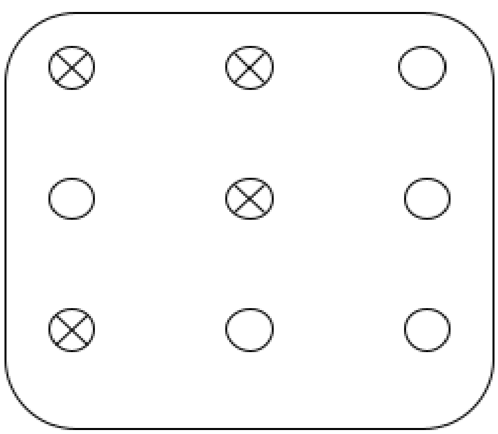


Determinant figure B:



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```
A = [ a11      a21

        a12
a22
]
```

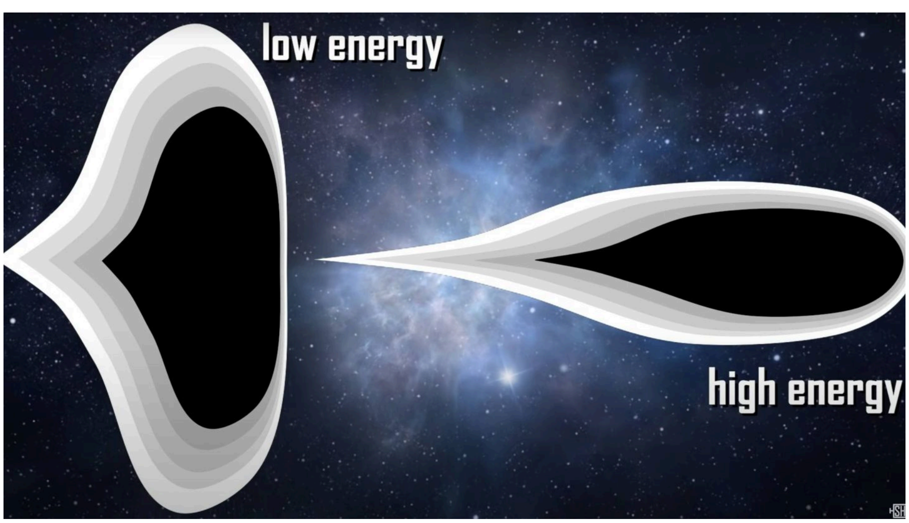
```
A11 * a22 - a21 * a12
```

Transpose different states in form of signals

*A	T12	T13
0	T22	T23
0	T32	T33

1
0
0

1
0
0



The spectral decomposition is carried out with the tools of a symmetric tensor that is usually decomposed into matrices with vectors as a polynomial trihedral which is (p1,p2,p3)

Simple decomposition scheme of a symmetric tensor:

ax (w * a) = 0

w = [0 0 0

0 0 -w

0 in 0]

Where we then have that the parameters [p,q,r] = 1

And the specific conditions of our symmetric tensor are:

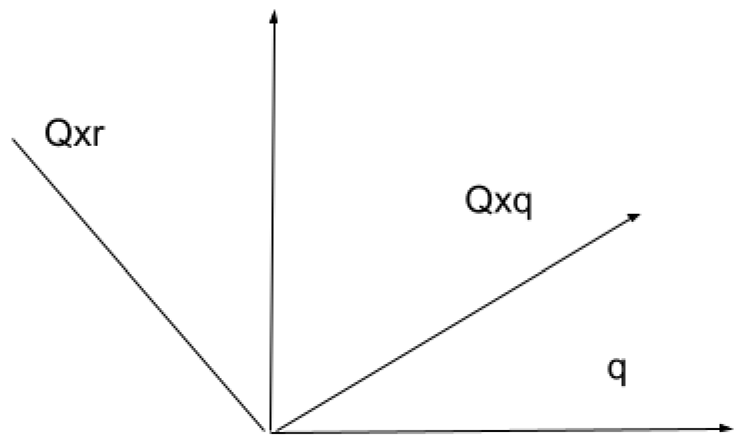
[@ y w = w (r $\otimes$ q - p $\otimes$ r)]

Other conditions that have to be met for the tensioner:

T1(w) = 0

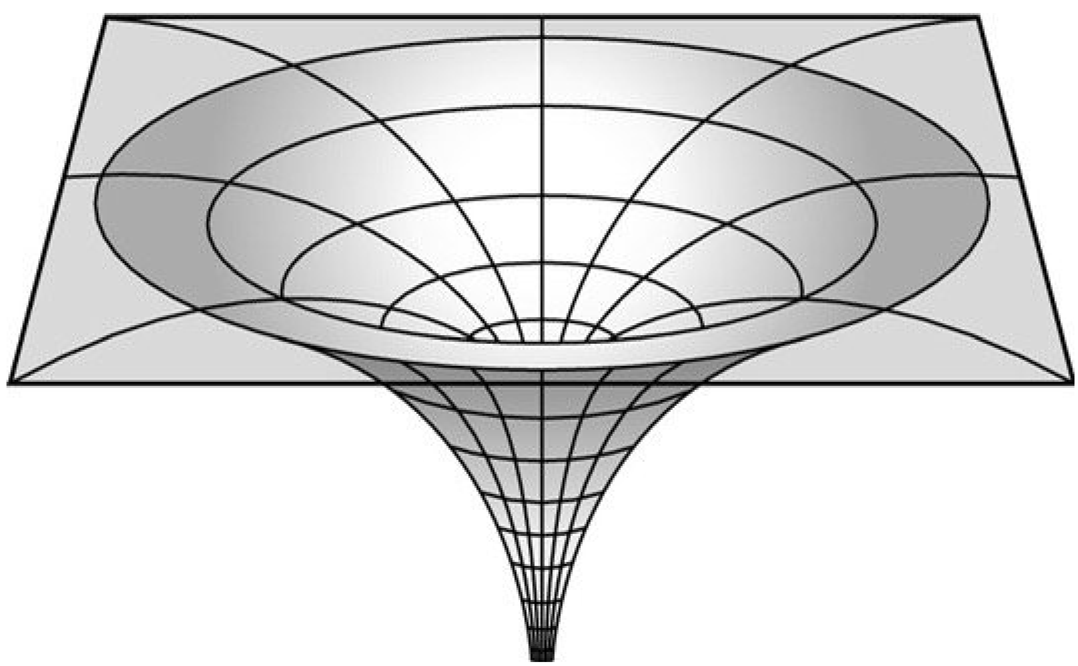
T2(w2) = w^{a}

T3(w) = 0



Tensor simple simétrico:
(p,q,r) son rotaciones ortogonales de las variables
(p,q) al vector del eje p

Tensor torsion figure:



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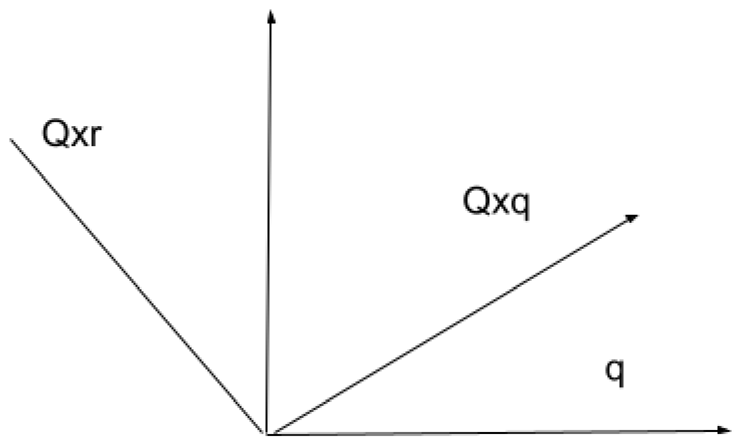
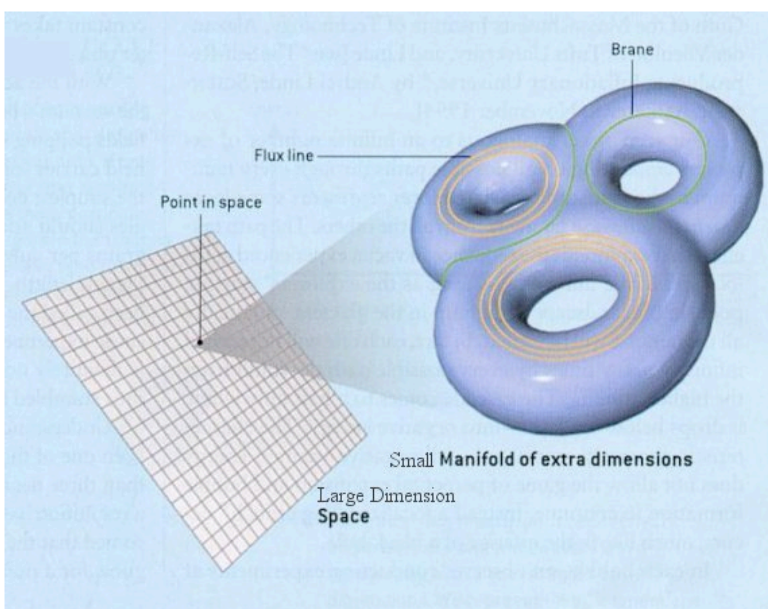


Other variables of the tensors in matrix components of A1,A2,A3

$$\boxed{\begin{aligned} &I1(S) = A1 + A2 + A3 \\ &I2(S) = A1 + A2 + A2(A3) + A3(A1) \\ &I3(S) = A1\ A2\ A3 \end{aligned}}$$



Tensor spaces of extra dimensions, larger dimensions:

J1 = I1

J2 = ½ I↕ $(0, 1) - I2$ (two states)

J3 = ½ I_{1}^{3} minus I1(I2) + I2 (three states)

J3 = ½ I_{1}^{4} minus I1(I2)(I3) + I4 (four states)

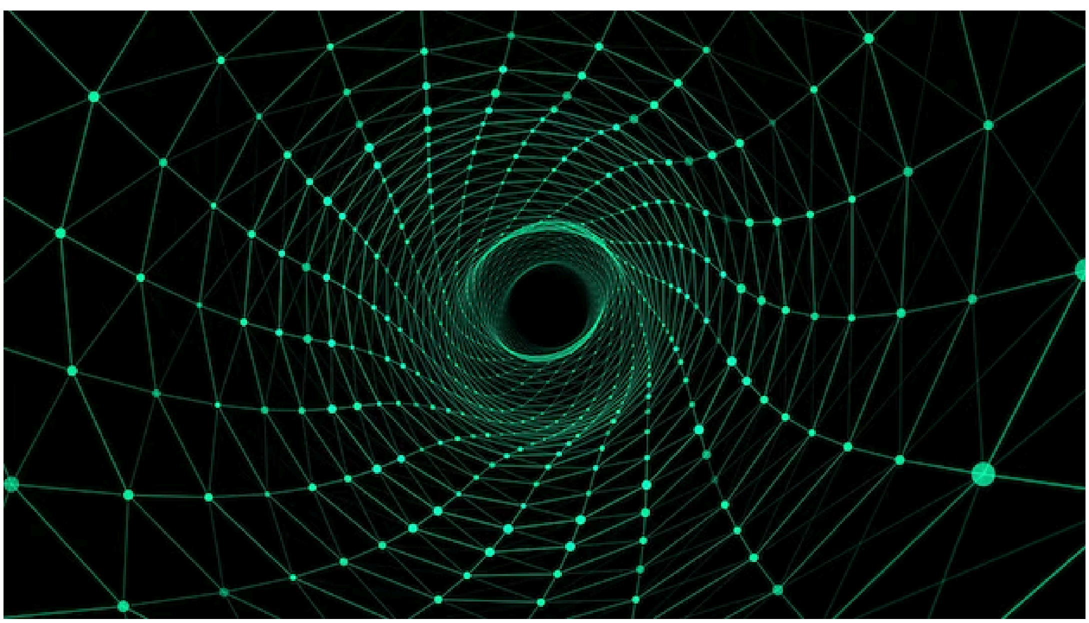
J5 = ½ $I_{1}^{5} - I1(I2)(I3)(I4) + I5$

J6 = ½ $I_{1}^{6*1} - I1(I2)(I3)(I4)(I5) + I6$

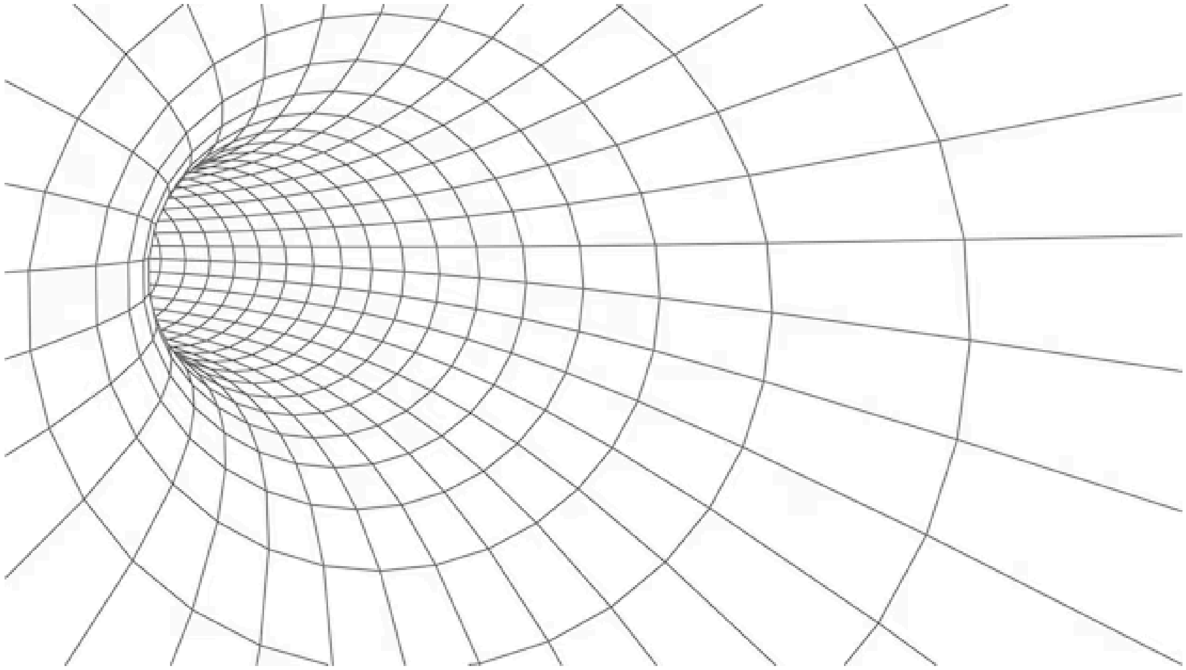
J7 = ½ $I_{1}^{7*1} - I1(I2)(I3)(I4)(I5)(I6) + I7$

Where J7 is the seventh dimension where the qubit is running in another multiple states and forms across special magnetic fields in a black hole or the tensor curvature

Graphic representation:



Graphical Representations and Tensor Equations



1. Scalar field
2. Vector field
3. Tensor field

$o\colon E\ {}^{3}_{1} > \ Dimension\ number\ of\ joints\ \ => \ R(space)\ x\ \ -> \ o(x)\ scalar\ vector$

V:E ${}^{3}_{1} \supset D - V,\ x\ \ -> \ v(x)\ is\ a\ vector\ field$

S: And

Definition: For any set of elements that form or are in a three-dimensional or higher space, such as space D, as well as for a set of vector spaces V whose exponent is the square, we will then have a tensor of S(x) called tensor of the tensor field subsets.

Note for definitions of superluminal particles and tensors: In a physical reality, it is suggested that although the vector structures are already delimited in these descriptions, it is worth highlighting the immense aspect of the proportions of these dimensions and that they work in conjunction with types of quantum particles that could be like mirrors at the spatial level of intergalactic structures with a singularity that is not known on planet Earth. It is possible to try to capture frequencies of these special particles, but the difficulty of this search for superluminal particles is that their composition is quantum and their number of dimensions is gigantic at points that are invisible and are transposed from place to place at speeds that adapt to curves of tensors in a practically extreme way and under conditions of gravity and magnetic fields that are not easily quantifiable, with instrumentation.

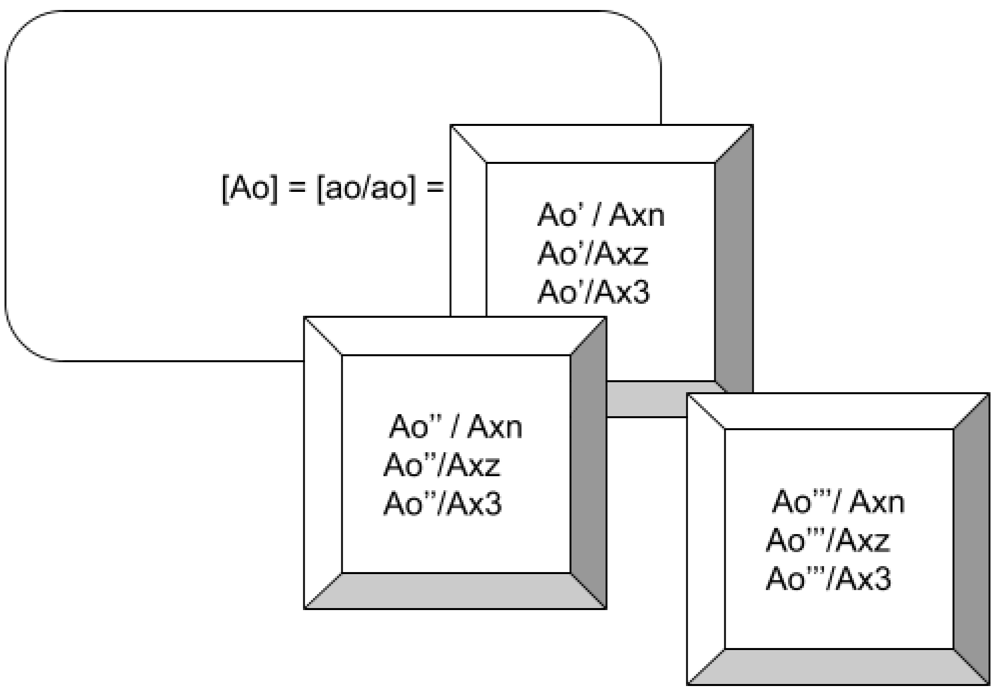
In our set of variables of a scalar field we have as an example

La forma o(x) = o(x1, x2, x3)

And its derivative or scalar field gradient is represented at a specific point or coordinate (x) in the three-dimensional plane as indicated by the expression $\vee\ v(x)$

$$\lim_{h \to 0} o(x + hu) - o(x) / h = \vee\ o(xxu)$$

Drawing 1.1



So our conclusion at this point of combinations of dimensional spaces is that the dimensions of **(x1, x2, x3)**

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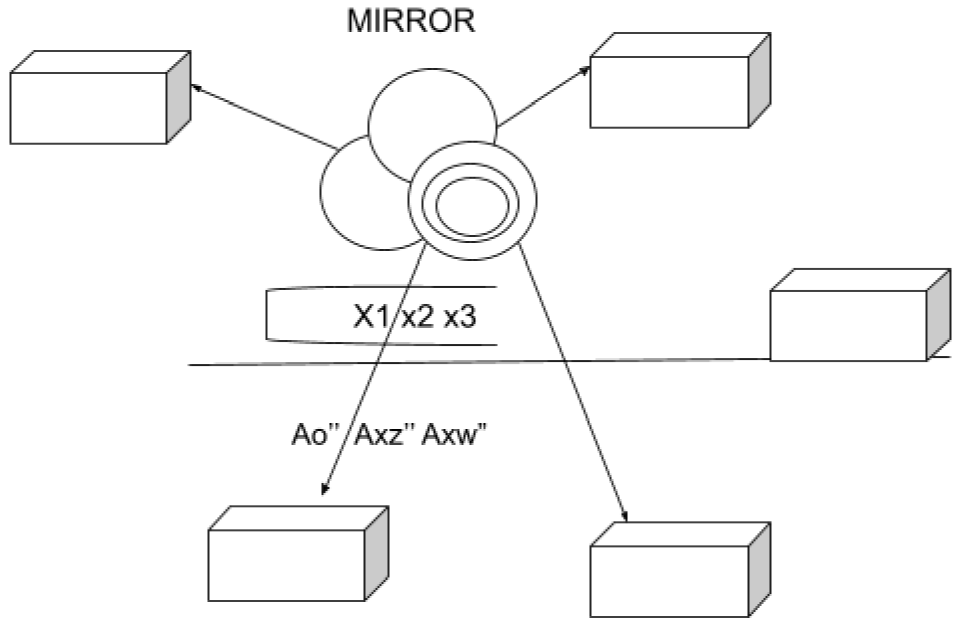
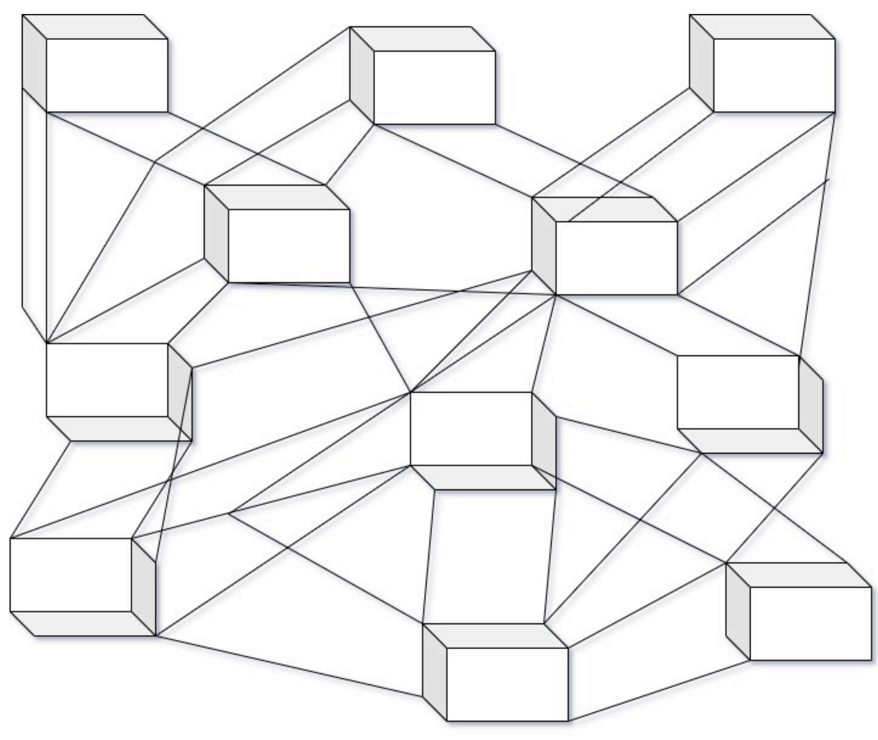


A graphical example of higher computing dimensions;



Enumerative combinatorics applied to higher dimensions for computational algorithms research;

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The main goal of enumerative combinatorics is to count the elements of a finite set. Most frequently, we encounter a family of sets T0, T1, T2, T3, . . . and we need to find the number tn = |Tn| for n = 1, 2, ...

For example, the tilings of Figure 1.1 correspond, respectively, to 1 + 1 + 1 + 1, 1 + 1 + 2, 1 + 2 + 1, 2 + 1 + 1, 2 + 2. These sums are easy to count. If there are k summands equal to 2 there must be n−2k summands:

and = bX n/2c , k=0 (n − k) k = n0 + (n − 1) ,1 + (n − 2) 2
+ · · · .

We can apply this formula to computational variables:

f(x + h, y + k) variables

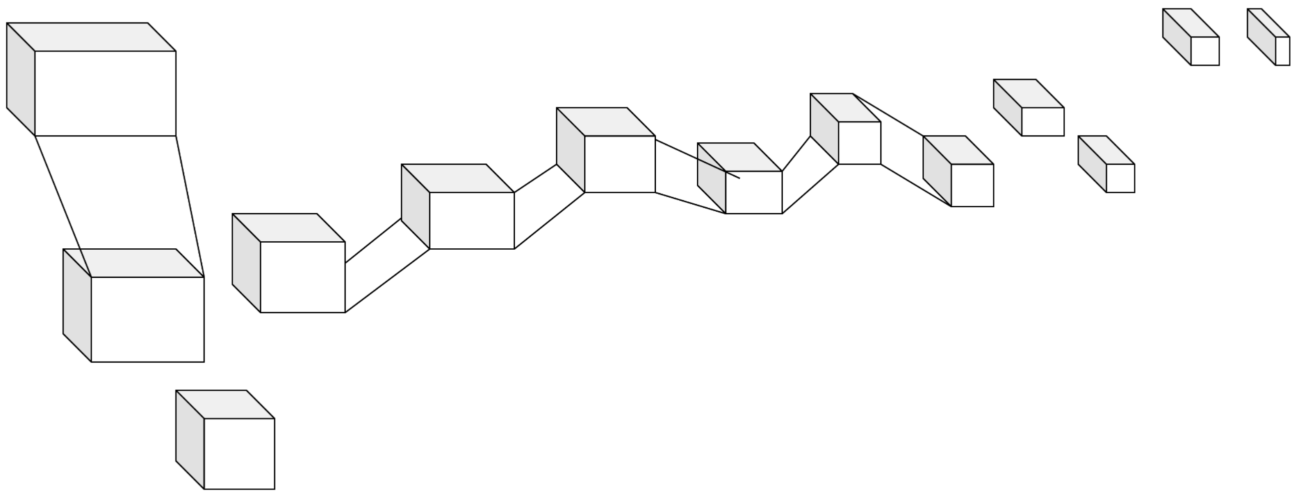
Decomposition

```
variable subzero = 0.0012
variable h = 2.12
variable y = 1.25
variable k = 2.00
```

f(x,y) + [hf'x(x,y) + KF'y(x,y) = 0

```
import Tfidf Vectorizer, CountVectorizer
From sklearn.decomposition import NMK, lateratDirichletAllocation
```

Graphical example of dimensions replication:
Replication Process-partitions-5D



About tensor spaces: When components, or a set of coordinates, are derived within the framework of a specific space(6), we then find a series of processes and transformations that form other spatial fields called dimensional mirrors or portals of quantum frequencies within the Riemann tensors. These tensor fields are transformed into quantum mirrors very similar to the properties described in quantum gravity, but the effects that accompany these transformations of quantum dimensions are the so-called superluminal quantum particles not yet discovered on planet Earth because these last supra-quantum particles have structures of extreme dimensions of, for example, let's say about 1000 dimensions and replications of transient structural states that are not part of known matter. The only way to perform operations and records is through software tools and strict computational physics, quantum cryptography. Here, these dimensions come into contact with so-called high-dimensional quantum mirrors that are somewhat difficult to understand visually.

In Riemannian geometry, Lie transport and Fermi transport are important concepts related to how vectors move along curves on a differentiable manifold. Let's explore these concepts along with the curvature tensor using simple examples and Python.

Lie Transport

The Lie transport of a vector field YYY along another vector field XXX is given by the Lie bracket [X,Y][X, Y][X,Y]. Mathematically, this is defined as:

LXY=[X,Y]\mathcal{L}_X Y = [X, Y]LXY=**[X,Y]**

Fermi Transport

Fermi transport is a special type of parallel transport in which the effects of rotation are eliminated when a vector is moved along a curve. It is particularly useful in the theory of general relativity.

For simplicity, imagine transporting a vector V along a γ(t)\gamma(t)γ(t) curve on a surface (2D variety). If V is transported parallel along γ(t)\gamma(t)γ(t) in a flat space, its covariant derivative along γ(t)\gamma(t)γ(t) is zero:

∇γ˙V=0, V = 0∇γ˙V=0

Curvature Tensor

The Riemannian curvature tensor RRR describes how spacetime curves on a Riemannian manifold. It is defined as:

```
R(X,Y)Z=∇X∇YZ−∇Y∇XZ−∇[X,Y]ZR(X, Y)Z = \nabla_X \nabla_Y Z -
\nabla_Y \nabla_X Z - \nabla_{[X,Y]} ZR(X,Y)Z=∇X∇YZ−∇Y∇X
Z−∇[X,Y]Z
```

where ∇\nabla∇ is the Levi-Civita connection.

Summary:
Everything described are other types of dimensions and realities that are part of the properties of other types of gravity in space with different high-dimensional properties at a structural level and replications and transpositions of a topic that I will explain in this book, which are the so-called particles. quantum superluminals that are not light or photons, but other types of structures with their own properties and that are not drawn or configured in planetary gravitational fields or in physically strong densities.

```
Setting n = 20
Element     1000000000     using     itertools.permutations()     is     =>
#1000000000(dimensions)                    to                    find
(0,1,2,3,4,5,6,9,8,7,15,17,14,16,19,11,13,18,10,12
```

Gradient Operator (∇)

In the context of vector calculus, the nabla operator is used to represent the gradient of a scalar function. If fff is a scalar function of the variables x,y,zx, y, zx,y,z (in three-dimensional space), the gradient of fff is given by:

```
∇f=(∂f∂x,∂f∂y,∂f∂z) ibla f = \left( \frac{\partial f}{\partial x},
\frac{\partial f}{\partial y}, \frac{\partial f}{\partial z}
\right)∇f=(∂x∂f,∂y∂f,∂z∂f)
```

fff gradient: ∇f=(2x,2y,2z)\nabla f = (2x, 2y, 2z)∇f=(2x,2y,2z)

Divergence of F\mathbf{F}F: ∇·F=y+z+x\{F} = y + z + x∇·F=y+z+x

Rotational of F\mathbf{F}F: ∇×F=(0,0,0)\times \mathbf{F} = (0, 0, 0)∇×F=(0,0,0)

Vector that points in the direction of the greatest rate of increase of f and whose magnitude is the rate of change in that direction.

Divergence Operator (∇·)

The blank operator is also used to represent the divergence of a vector field. If F=(Fx,Fy,Fz)\mathbf{F} = (F_x, F_y, F_z)F=(Fx,Fy,Fz) is a vector field, the divergence of F\mathbf{F}F is given by:

```
∇·F=∂Fx∂x+∂Fy∂y+∂Fz∂z\nabla\cdot\mathbf{F} = \frac{\partial
F_x}{\partial x} + \frac{\partial F_y}{\partial y} + \frac{\partial
F_z}{\partial z}∇·F=∂x∂Fx+∂y∂Fy+∂z∂Fz
```

Divergence measures the net rate of outflow of a vector field from a point.

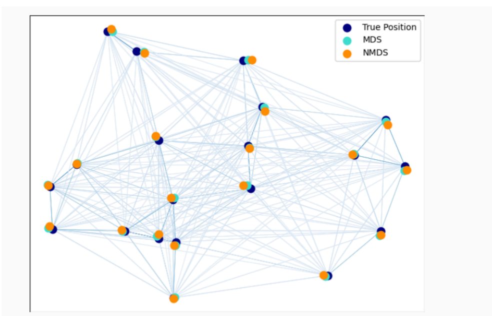
Rotational Operator (∇×)

Engineering, collections

The nabla operator is also used to represent the curl of a vector field. Yeah **F=(Fx,Fy,Fz)**\mathbf{F} = (F_x, F_y, F_z)**F=(Fx,Fy,Fz)** is a vector field, the curl of F\mathbf{F}F is given by:

```
∇×F=(∂Fz∂y−∂Fy∂z,∂Fx∂z−∂Fz∂x,∂Fy∂x−∂Fx∂y)\nabla \times
\mathbf{F}
```

The rotational measures the tendency of a vector field to rotate around a point.



Examples in Different Contexts

1. **Scalar field in 3D:**

```
   ○ f(x,y,z)f(x, y, z)f(x,y,z): Scalar function.
   ○ ∇f=(∂f∂x,∂f∂y,∂f∂z)\nabla f = \left( \frac{\partial
     f}{\partial x}, \frac{\partial f}{\partial y},
     \frac{\partial f}{\partial z}
     \right)∇f=(∂x∂f,∂y∂f,∂z∂f).
```

Coordinate Decomposition

In Cartesian coordinates, a 3D vector field is decomposed into its vector components along the xxx, yyy, and zzz axes. Mathematically, this can be written as:

```
F(x,y,z)=(Fx(x,y,z),Fy(x,y,z),Fz(x,y,z))\mathbf{F}(x, y, z) = (F_x(x, y, z),
F_y(x, y, z), F_z(x, y, z))F(x,y,z)=(Fx(x,y,z),Fy(x,y,z),Fz(x,y,z))
```

Here, FxF_xFx, FyF_yFy and FzF_zFz are scalar functions that represent the components of the vector in the x, y & z directions, respectively.

Examples of Vector Fields

1. **Fluid Flow (Laminar Flow):** In a laminar flow, the vector field can represent the velocity of the fluid at each point in space. For example, in a flow through a pipe, the velocity vector field v\mathbf{v}v could be described as:

```
v(x,y,z)=(vx(x,y,z),vy(x,y,z),vz(x,y,z))\mathbf{v}(x, y, z)
= (v_x(x, y, z), v_y(x, y, z), v_z(x, y,
z))v(x,y,z)=(vx(x,y,z),vy(x,y,z),vz(x,y,z))
```

2. **Force Field (Physics):** In physics, a field of forces, such as the gravitational field or the electric field, can be represented by a vector field. For example, the gravitational field near the Earth's surface can be approximated as:

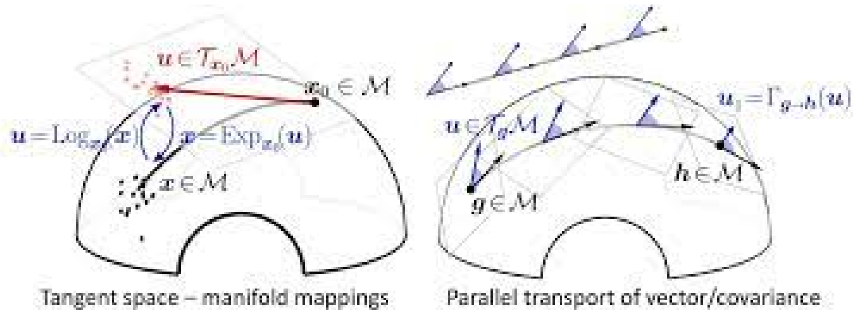
```
g(x,y,z)=(0,0,-g)\mathbf{g}(x, y, z) = (0, 0,
-g)g(x,y,z)=(0,0,-g)
```

Gravitational acceleration on the surface of a black hole;

1. **Direction of an Airplane:** The direction and speed of an airplane in flight can be represented by a 3D vector field, where at each point in the airspace the vector indicates the speed of the airplane in that position.
2. The intensity of a black hole's gravitational field can be characterized in several ways:
3. **Gravitational Acceleration on the Surface:**
   The gravitational acceleration ggg on the surface of a black hole can be estimated using the mass of the black hole and its radius. Although there is no physical surface on a black hole (because it is an extremely compact object), we can use the Schwarzschild radius to

calculate an approximation of the gravitational acceleration near its event horizon.

4. **Conclusion D:** A 3D vector field is a function that assigns a vector to each point in space, and these vectors can represent various quantities such as the speed of a laminar flow, the force in a gravitational field, or the direction of an airplane. These magnitudes are decomposed into their components in the coordinate directions of space.



Variables and Notation

1. **Variety and Coordinates:** a variety **MMM** It is a space in which we can define local coordinates. For example, around a point in spacetime, we can use coordinates (t,x,y,z)(t, x, y, z)(t,x,y,z).
2. **Metric:** The metric is a function that defines the distance on the manifold. In the spacetime of general relativity, the metric can vary from one point to another and is represented by a second rank tensor
3. **Vector Fields:** A vector field **V\mathbf{V}V** in a variety it is represented as **VμV^\muVμ**, where **m\mum** denotes the index corresponding to the local coordinates (t,x,y,z)(t, x, y, z)(t,x,y,z).
4. **Riemann Curvature Tensor:** This tensor describes how the metric changes as we move around the manifold. It is crucial to understanding the curvature of space-time.

Python:

```
# Riemann curvature tensor R = sp.MutableDenseNDimArray([0] * 4**4,
(4, 4, 4, 4)) for i in range(4): for j in range(4): for k in
range(4): for l in range(4): R[i, j, k, l] =
sp.simplify(sum([sp.diff(Gamma[i, j, l], var) for var in (t, r,
theta, phi)][k]) - sum([sp.diff(Gamma[i, j, k], var) for var in (t,
r, theta, phi)][l]) + sum([Gamma[m, j, l] * Gamma[i, k, m] -
Gamma[m, j, k] * Gamma[i, l, m] for m in range(4)])) # Mostrar las
conexiones de Christoffel y el tensor de curvatura de Riemann
Gamma, R
```

1. G is the gravitational constant.
2. M is the mass of the black hole.

Conclusion: The notation and variables we use in Riemannian geometry, especially general relativity, are complex, but essential for describing the curvature of spacetime. Vector fields and curvature tensors allow us to understand phenomena such as gravity and the curvature of space-time around massive objects such as black holes. Using symbolic tools like SymPy helps us calculate and visualize these concepts accurately.

Variety

In mathematics and theoretical physics, a manifold is a geometric space that locally resembles Euclidean space. Formally, a manifold M is defined as a topological space that is locally homeomorphic to a Euclidean space of dimension n. This means that at each point on the manifold, we can find an environment that is "like" a Euclidean dimensional space.

In the context of physics, especially in the theory of general relativity, spacetime is a four-dimensional manifold. This means that at each point in space-time, we can define a set of four coordinates (three spatial and one temporal) that locally describe space-time as a four-dimensional Euclidean space.

Space-Time and Metrics (Black Holes)

Spacetime in general relativity theory is described using a metric, which is a function that specifies the distance between infinitesimally close points in spacetime. The metric is typically represented by gμνg_{\mu\nu}gμν, where μ,ν\mu, \nuμ,ν are indices ranging from 0 to 3 (for coordinates **t,x,y,zt, x, y, zt,x,y,z** in three-dimensional space plus time).

Metric Components

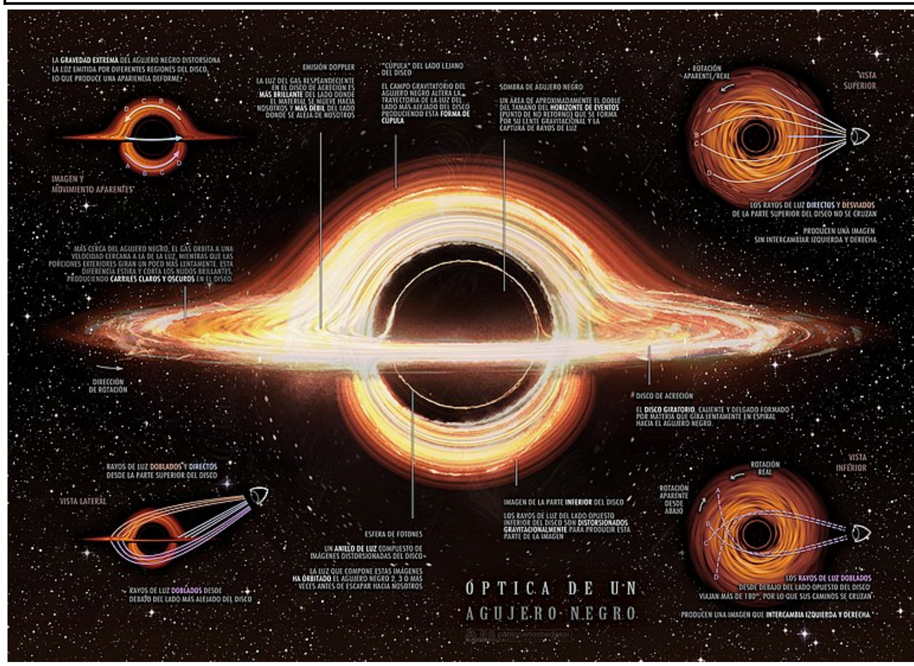
In a general metric, such as the Schwarzschild metric around a black hole, the components gμνg_{\mu\nu}gμν specify how the spacetime interval varies in different directions. For example, for the Schwarzschild metric in spherical coordinates **(t,r,θ,ϕ)(t, r, \theta, \phi)(t,r,θ,ϕ)**

Metric components:

```
g00=-(1-r2GM): Component that affects the time interval

g11=(1-r2GM)-1: Component that affects the radial interval
dr2dr^2dr2.
g22=r2g_{22} = r^2g22=r2: Component that affects the angular
interval dθ2d\theta^2dθ2.

g33=r2sin2θg_{33} = r^2 \sin^2 \thetag33=r2sin2θ: Component that
affects the angular interval dϕ2d\phi^2dϕ2.
```



Metric Derivatives (∂μgνσ\partial_\∂μ gνσ)

The derivatives of the metric refer to the partial derivatives of the components of the metric with respect to the space-time coordinates. These derivatives are used to calculate the Christoffel connections, which in turn are used to calculate the Riemann curvature tensor. The intensity of a black hole's gravity is primarily described by its mass and its characteristic radius, which is the radius of its event horizon (also known as the Schwarzschild radius). Here are the key concepts related to the gravity of a black hole:

Quantum integration formula to Christoffel connections metrics:

```
D^(a) D^(b) = e
Aβ*−α *βD^(α + β) (9)
D^(α) ^a D^ +(α) = ^a + α (10)
D^(α) ^a† D^ +(α) = ^a†α*
```

Black Hole Mass

The mass M of a black hole is a direct measure of its gravitational influence. The greater the mass of the black hole, the stronger its gravitational field in its nearby environment.

Schwarzschild radio

The Schwarzschild radius rsr_srs is a measure of the size of the event horizon of a spherical black hole and is given by the formula:

rs=2GMc2r_s = \frac{2GM}{c^2}rs=c22GM

Where:

- G is the gravitational constant.
- M is the mass of the black hole.
- C is the speed of light in a vacuum.

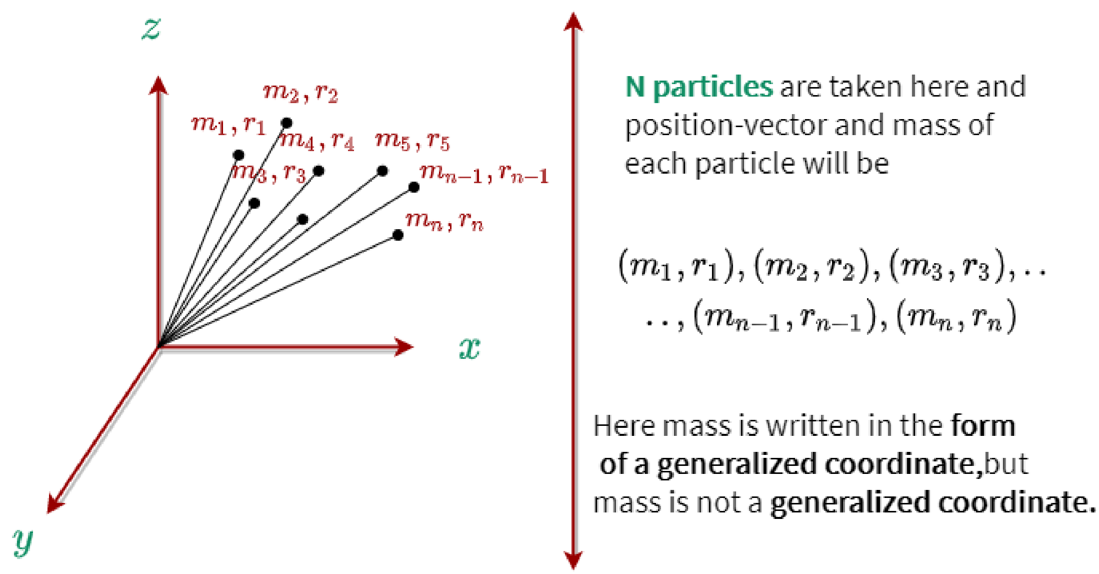
Christoffel connections Γρ;

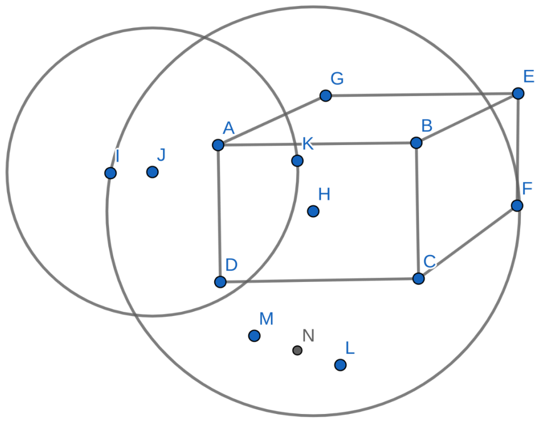
Christoffel connections are coefficients that appear in the decomposition of the covariant derivatives of vectors in a curved space-time. They are related to the derivatives of the metric and are defined by:

$\boxed{\mathbf{Gnr}=21g\rho(\partial\mu\sigma+\partial\nu\mu\ \sigma-\partial\sigma g\mu\nu)}$

In summary, in the theory of general relativity:

- **Variety:** It is space-time that locally behaves like a four-dimensional Euclidean space.
- **$g\mu\nu$ metric:** It is a function that describes the geometric structure and curvature of space-time.
- **Derivatives of the Metric $\partial\mu g\nu\sigma$:** They are the partial derivatives of the components of the metric with respect to the space-time coordinates.
- **Conexiones de Christoffel Gym\Gnr:** They are coefficients that arise when differentiating vectors in a curved space-time, related to the derivatives of the metric.





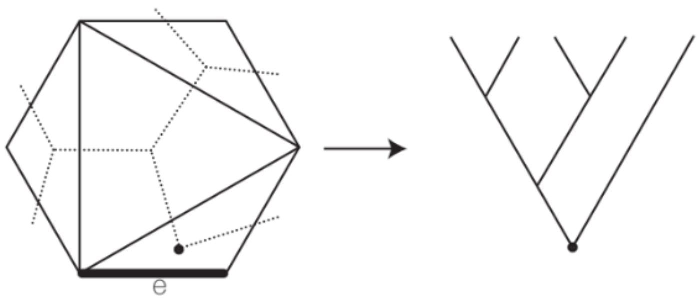
Impact on Space-Time around the Black Hole

- These components of the metric determine how the spacetime intervals change near the black hole. The presence of the MMM mass directly affects the curvature of space-time, modifying the trajectories of particles and the propagation of light.
- Singularities in the metric, such as r=2GMr = 2GMr=2GM, indicate regions where the curvature is extreme, such as the event horizon of a black hole.

Conclusion: It could be more relevant to propose different types of quantum gravity at structural levels and to propose the structures of practical examples with quantum particles at the level of computing the variables to obtain results from the physics of high-dimensional components with metrics and tensors in a simple way. .

Docker swarm and Python or Kubernetes are valuable software tools for complex computational calculations that could be used with metrics of black holes where there are nearby stars, and in that way we could also compute the properties and characteristics of said stars along with quantum cryptography calculations. with quiskit in the Python programming language.

The most advisable thing to work with physics is not to use concepts such as space, time and the classical general theory of relativity as priority instruments, the priority instruments are the structures of high dimensions in 4D, 5D and the structures of the curvature of tensors and superluminal particles.



Supralight Velocity and Black Holes

The idea of a massless particle moving at a supraluminal speed (greater than the speed of light) and its interaction with a black hole raises several important aspects:

1. **Event Horizon and Escape Velocity:**
    a. The event horizon of a black hole is the region from which neither light nor any other particles can escape due to the intense gravity of the black hole.
    b. The escape velocity at the event horizon is equal to the speed of light, ccc. No particle, including those traveling at the speed of light, can escape this limit.
2. **Massless Particles and Their Interaction with Gravity:**
    a. Massless particles, such as photons, follow geodesic trajectories in spacetime curved by the black hole. This means that they follow the curvature lines of space-time, moving at ccc and adjusting to the curvature caused by the mass of the black hole.
    b. The gravity of a black hole is so intense that it can significantly bend space-time. This affects the particle trajectories, but does not allow a supraluminal particle (larger than variable C) to enter or merge in a conventional manner.
3. **Cosmic Censorship Theorem:**
    a. In black hole physics, there is the concept of the Cosmic Censorship Theorem, which suggests that singularities within a black hole are "censored" from our view and cannot directly affect outside observations.
    b. This implies that a supraluminal particle is not expected to be able to directly interact with a singularity within a black hole in a physically coherent way.

In current physics, particles that travel faster than light (superluminal) are not contemplated in the framework of special and general relativity, which establishes that the speed of light in a vacuum (C) is the maximum limit for the speed of any particle or signal in the known universe.

However, if we speculate on the theoretical possibility of particles that travel faster than light and have the ability to interact with additional dimensions or entities like black holes, we might consider the following hypothetical features:

Hypothetical Characteristics of Supraluminous Particles

1. **Superluminal Speed:**
   a. They travel at speeds greater than the speed of light ccc. This property would make them capable of overcoming the limitations of normal particles in terms of distance and time.
2. **Structure and Properties:**
   a. They do not behave like photons, they do not have the same structure as known particles. Their behavior and properties could be radically different from those of the standard particles of the Standard Model of particle physics.
3. **Interaction with Extra Dimensions or Black Holes:**
   a. Hypothetically, they could interact with extra dimensions in extra-dimensional theories, such as those proposed in string theory or in modified gravitation models.
   b. Near black holes, they could have properties that allow them to explore regions of space-time not accessible to normal particles.
4. **Stability and Physical Effects:**
   a. Their stability and how they interact with the extreme gravitational environment of a black hole or near massive stars would be topics of theoretical speculation. They could exhibit different gravitational and electromagnetic effects due to their speed and hypothetical structure.

Python:

```
Begin array demo
Creating array arr using np.array() and list with hard-coded values Cell
element type is float64
Printing array arr using built-in print()
[ 1. 3. 5. 7. 9.]
Creating int array arr using np.arange(9)
Printing array arr using built-in print()
[0 1 2 3 4 5 6 7 8]
Printing array arr using my_print() with cols=4 and dec=0
0 1 2 3
4 5 6 7 8
Creating array arr using np.zeros(5)
Printing array arr using built-in print()
[ 0. 0. 0. 0. 0.]
Creating array arr using np.linspace(2., 5., 6)
```

Integration of Qubits and Extra Dimensions

Engineering, collections

1. **Qubits and Quantum Computing:**
   - Qubits are the fundamental blocks of quantum computing, capable of representing and processing information in a quantum way. Unlike classical bits, which can only be in states 0 or 1, qubits can be in superpositions of these states and can be quantum entangled.
2. **Riemann Curvature and Extra Dimensions:**
   - In string theory and some theories of quantum gravity, the existence of additional dimensions beyond the three spatial dimensions and one temporal dimension that we observe is postulated. These additional dimensions may be "compacted" or rolled up on very small scales, not directly accessible to our classical observations.

3. **Particles and Quantum Behavior:**
   - In a speculative approach, we could consider the existence of quantum particles that interact with these extra dimensions in a way that goes beyond what we can describe with classical tensors. These particles could have extended quantum properties, such as superpositions and entanglements that involve these additional dimensions.
4. **Fusion with Higher Dimensions of Riemann Curvature:**
   - Imagine a scenario where quantum particles, with their extended properties, can merge or interact significantly with the extra dimensions of Riemannian geometry. This could involve gravitational or quantum electromagnetic effects that are not observed in our visible universe, but could be relevant on very small scales or in extreme conditions near massive objects such as black holes.

Quantum and Computational Aspects

- **Interlacing and Overlay:** Quantum particles could exhibit extended entanglement and superposition, which could influence how they interact with complex geometric structures.
- **Information and Quantum Computing:** Quantum information encoded in qubits could have a richer and more complex representation when interactions with extra dimensions and curved geometries are considered.
- **Quantum Computing in Curved Geometries:** Explore how quantum algorithms and quantum computing techniques could be adapted to understand or model phenomena in curved geometries, potentially with implications in the simulation of black holes or cosmological structures.

Conclusions

This theoretical approach opens up interesting possibilities for the integration of quantum and computational physics concepts with differential geometry and extra-dimensional theories. Although currently speculative and theoretical, exploring these ideas could lead to new insights into how quantum information and particle properties could influence the understanding of cosmological and gravitational phenomena at microscopic and macroscopic scales.

String Theory

String theory is a theoretical proposal that attempts to describe all the fundamental particles and forces of the universe in terms of a single basic entity: vibrating one-dimensional strings. In string theory, for the equations to be mathematically consistent, spacetime is required to have more dimensions than we observe.

1. **Compacted Dimensions:**
    - In string theory, extra dimensions are compactified or "rolled up" to very small scales (of the order of the Planck length, ~10−35\sim 10^{-35}~10−35 meters), which means which are not directly observable with our current methods.
    - These compacted dimensions explain why we do not perceive them in our daily lives, since they are rolled up in very small dimensions and their effects only manifest themselves on extremely small or energetically high scales.

2. **Mathematical Consistency:**
    - String theory provides a coherent mathematical structure that unites quantum gravity with the other fundamental forces (electromagnetic force, strong and weak nuclear force).
    - The extra dimensions are necessary for the strings to vibrate consistently and for the theory to be finite and free of the singularities that plagued previous attempts to combine general relativity and quantum mechanics.

Quantum Gravity Theories

In addition to string theory, there are other proposals in the field of quantum gravity that also postulate the existence of extra dimensions:

1. **Loop Quantum Gravity:**
    - This is another approach to quantum gravity that attempts to quantize the geometry of space-time through structures called loops. In this theory, extra dimensions may be involved in the discrete structure of space-time at very small scales.
2. **Safe Asymptotic Quantum Gravity:**
    - It proposes that quantum gravity can be treated as an effective theory at certain energy scales, where additional dimensions can manifest themselves in terms of new physical structures and phenomena.

Implications and Experimentation

So far, extra dimensions are mainly a theoretical and mathematical construct. There is no direct experimental evidence of its existence due to its small compacted size. However, high-energy experiments in the future could indirectly provide evidence of additional dimensions if they show deviations from the predictions of standard physics.

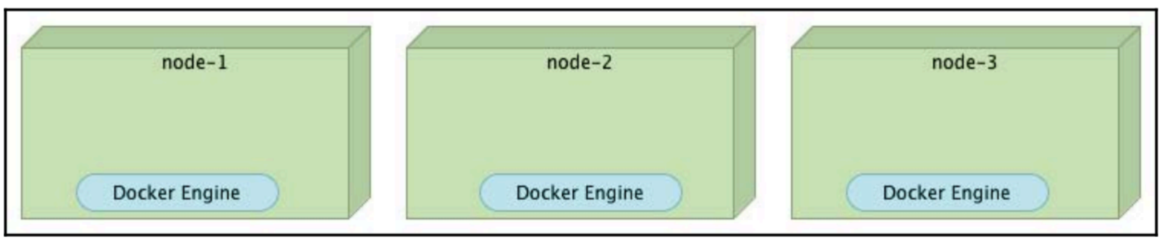
Note to reader:

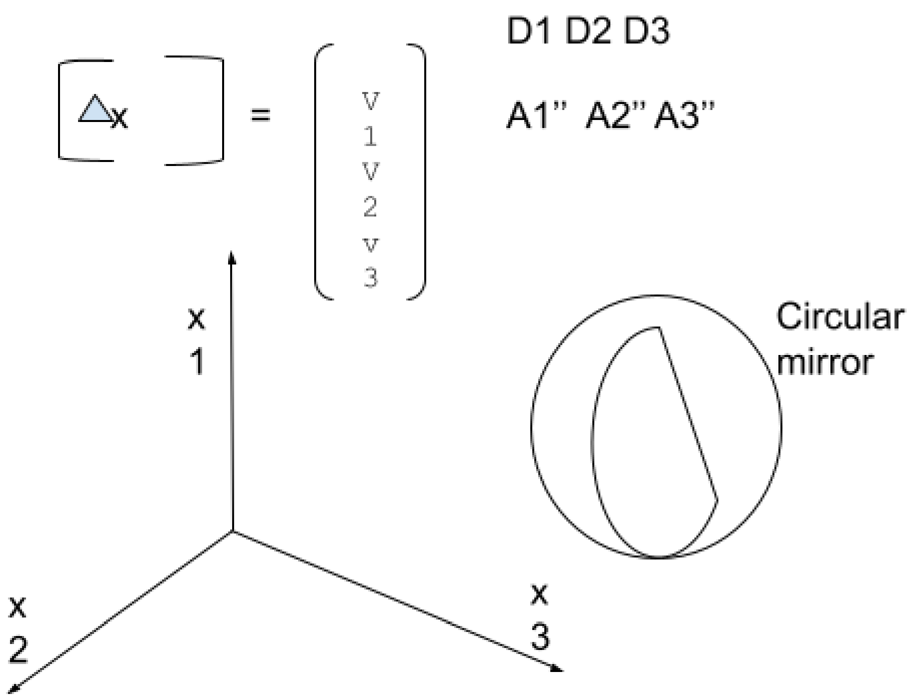
This theoretical and speculative approach will allow you to explore the intersections between Riemann geometry, quantum computing, extra dimensions, Cherenkov radiation and advanced gravitational phenomena. Although these concepts are still in the realm of speculation and theory, they can provide a solid foundation for new research and understanding at the intersection between quantum physics and gravitation.

Example of a quantum mirror of virtualBox networks within the curvature of a tensor with docker:

The output is as follows (ERROR column removed for brievity):

```
NAME    ACTIVE DRIVER       STATE   URL                         SWARM DOCKER
node-1  -      virtualbox   Running tcp://192.168.99.100:2376 v1.12.1
node-2  -      virtualbox   Running tcp://192.168.99.101:2376 v1.12.1
node-3  -      virtualbox   Running tcp://192.168.99.102:2376 v1.12.1
```





Aircraft with superluminal structure:

Within a possible proposition, we could find aircraft that are part of types of quantum structures and that would have the ability to merge or curve within high-dimensional structures (36D) although it is only a hypothetical case, raising this possibility that An aircraft may be made of superluminal quantum particles that modify their own states or structural dimensions (7D-8D) but it still has a physical meaning within the quantum framework.

Superluminal Frequencies and Black Holes

Introduction: The relationship between terminals and the virtualization of a dimensional system or a galaxy:

Terminal as Access Point: In the virtualization of a dimensional system or galaxy, we could think of the terminals as access points to different parts of the system. Just as a computer terminal provides access to a computer system, access points in a dimensional or galactic system could be ways to interact with different dimensions or regions of space.

Commands as Access Protocols: The commands executed in a terminal could be compared to the protocols or access methods used in the virtualization of complex systems. Just as commands on a terminal allow the user to interact with the computer system, access protocols could allow users to interact with different aspects of a dimensional or galactic system.

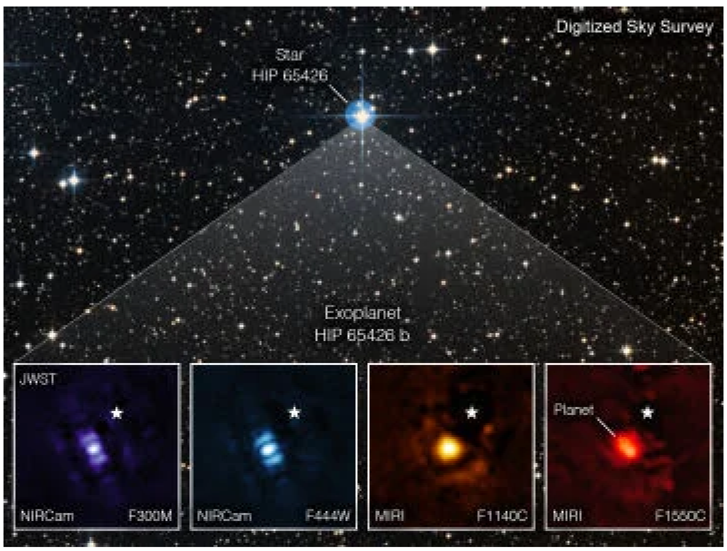
Radio Frequencies as a Form of Communication: In science fiction, radio frequencies are often used as a form of communication between different parts of a galactic system. If we imagine a virtualized dimensional or galactic system, we could conceive that "radio frequencies" could be a way to access or communicate with different parts of that system.

Limitations: The idea of virtualizing components of a galaxy at a very high-dimensional level resembles concepts from theoretical physics and speculative science. Although we currently do not have the technology or complete understanding to implement something so complex, we can explore some related ideas and concepts:

String Theory and Extra Dimensions: String theory is a theoretical framework in physics that suggests that fundamental particles are actually vibrating strings in more than four-dimensional spacetime. This approach could imply the existence of additional dimensions beyond the three spatial dimensions and the temporal dimension that we experience. In theory, we could imagine virtualizing complex systems in these additional dimensions.

Quantum Simulations and Quantum Computing: Quantum computing is exploring new ways of processing information using the principles of quantum mechanics. In theory, quantum computers could be able to simulate complex quantum systems, such as those that might be found in a galaxy, with a level of detail and precision that classical computers cannot achieve.

Cosmological Simulations: Cosmologists and astrophysicists use computer simulations to model the evolution and behavior of galaxies, galaxy clusters, and the universe as a whole. These simulations can take into account a variety of factors, such as gravity, dark matter, dark energy, and large-scale particle-field interactions. Although these simulations are limited in dimensions and details, they represent a step toward understanding the complexity of cosmic systems.



Quantum hash (comparison with docker swarm)

Here we try to represent properties of a possible curve near a star as if it were a hash algorithm in a didactic example:

```
Swarm initialized: current node (1o5k7hvcply6g2excjiqqf4ed) is now
a manager. To add a worker to this swarm, run the following
command: docker swarm join \ --token
SWMTKN-1-3czblm3rypyvrz6wyijsuwtmk1ozd7giqip0m \
6k0b3hllycgmv-3851i2gays638e7unmp2ng3az \ 192.168.99.100:2377 To
add a manager to this swarm, run the following command: docker
swarm join \ --token SWMTKN-1-3czblm3rypyvrz6wyijsuwtmk1ozd7giqi \
```

Unification of Concepts

1. **Riemann Geometry and Tensors:**
    - In general relativity theory, Riemann tensors describe the curvature of spacetime due to the presence of matter and energy. These tensors are essential to understanding complex gravitational phenomena such as black holes and singularities.
2. **Qubits and Quantum Computing:**
    - Qubits are fundamental units of information in quantum computing, capable of existing in superpositions of states and entanglements. Their potential to represent and process information exponentially more efficiently than classical bits makes them fundamental in various theoretical applications, including high-dimensional models and complex quantum simulations.
3. **High Dimensional Combinatorics:**
    - High-dimensional combinatorics is the study of structures and properties in higher-dimensional spaces, which is relevant in contexts such as string theory, where compactified additional dimensions are postulated.
4. **Cherenkov Radiation and Black Holes:**
    - Cherenkov radiation is emitted when a particle travels through a medium at a speed greater than the speed of light in that medium. In the context of black holes, quantum particles could exhibit similar phenomena at the edge of the event horizon, albeit at extremely high speeds, still within the limits of general relativity.
5. **Boundary Layer and Superluminal Particles:**
    - The boundary layer is a region of laminar flow around a moving body, where significant effects occur due to the interaction between the object and the surrounding medium. Analogously, hypothetical superluminal particles could undergo complex interactions in the vicinity of extreme gravitational structures, such as black holes, manifesting special quantum and structural properties.

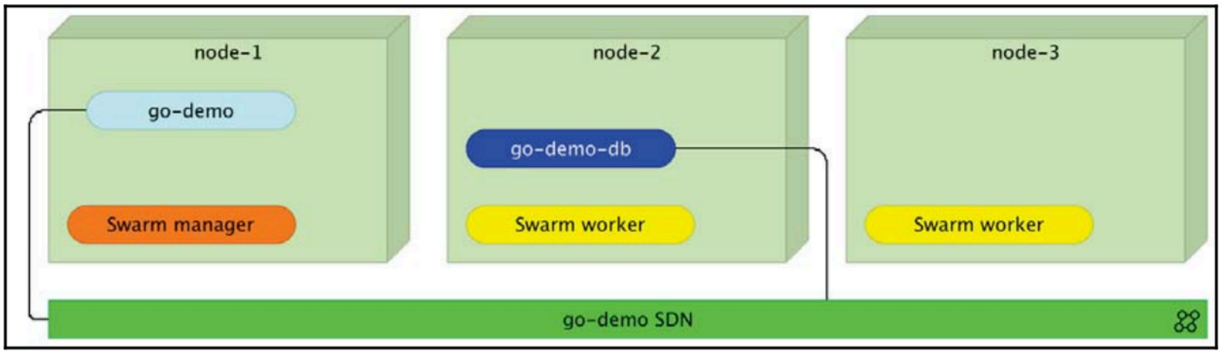
New search models for star properties,

Some relationships could coexist between the virtualization of terminals (Linux) or computations and how quantum gravity and high dimensions operate that could be interesting to test new models for searching for exoplanets or stars. Through nodes or networks, dimensions and volumes of star data could be analyzed with Python that could be effective:

The result, after the `go-demo` service is pulled to the destination node, should be as follows (IDs are removed for brevity):

```
NAME        MODE       REPLICAS IMAGE
go-demo     replicated 1/1      vfarcic/go-demo:1.0
go-demo-db  replicated 1/1      mongo:3.2.10
```

As you can see, both services are running as a single replica:



Example of networks with docker for networks;

```
The output of the OFUXPSLMT command is as follows:
NETWORK ID NAME DRIVER SCOPE
e263fb34287a bridge bridge local c5b60cff0f83 docker_gwbridge
bridge local 8d3gs95h5c5q go-demo overlay swarm 4d0719f20d24 host
host local eafx9zd0czuu ingress overlay swarm 81d392ce8717 none
null local
```

Conclusion:

Based on Theoretical Physics and Cosmology: Riemann tensors are fundamental tools in Einstein's theory of general relativity, which describes gravity as the curvature of space-time. Investigating how tensors behave in extreme environments such as black holes will lead you to a better understanding of the physics of these objects.

Observable Phenomena and Current Theories: Shock waves, magnetic fields and superluminal velocities in black holes are observable phenomena and are related to current theories in astrophysics and cosmology. Studying these phenomena will allow you to understand how they interact and how they can be observed from Earth or using space instruments.

Engineering, collections

Challenges and Advances in Research: These topics represent significant challenges in current scientific research. Understanding them requires a deep knowledge of theoretical physics, advanced mathematics, and the ability to model and simulate complex systems. By diving into these topics, you will be contributing to the understanding of some of the greatest mysteries of the universe.

Intersection with Technology and Innovation: Research in these fields not only expands our fundamental knowledge of the universe, but also has potential applications in emerging technologies such as space exploration, quantum communication, and advanced computing.

Swarm needs a bit of time until it detects that the node is down. Once it does, it will reschedule containers. We can monitor the situation through `service ps command`:

```
docker service ps go-demo
```

The output (after rescheduling) is as follows (`ID` is removed for brevity):

```
NAME        IMAGE               NODE   DESIRED STATE CURRENT STATE             \ERROR PORTS
go-demo.1   vfarcic/go-demo:1.0 node-2 Running       Running 13 seconds ago
_ go-demo.1 vfarcic/go-demo:1.0 node-3 Shutdown      Running about a minute ago
go-demo.2   vfarcic/go-demo:1.0 node-2 Running       Running about a minute ago
go-demo.3   vfarcic/go-demo:1.0 node-2 Running       Running about a minute ago
go-demo.4   vfarcic/go-demo:1.0 node-1 Running       Running about a minute ago
go-demo.5   vfarcic/go-demo:1.0 node-1 Running       Running 13 seconds ago
_ go-demo.5 vfarcic/go-demo:1.0 node-3 Shutdown      Running about a minute ago
```

Quantum oscillator:

To represent an oscillator in a 5-dimensional space with frequency measurements, we can consider each dimension as a frequency in a specific domain. For example, we could have frequencies for the three spatial dimensions (x, y, z), a frequency for time, and an additional frequency that represents some specific property of the oscillator in that additional dimension.

Conceptualization of the Oscillator in 5 Dimensions:

- **Spatial Dimensions (x, y, z)**: The frequencies in these dimensions could represent the spatial position of the oscillator in three-dimensional space.
- **Time**: The frequency in this dimension would represent the change over time, that is, the temporal evolution of the oscillator.
- **Additional Dimension**: The frequency in this additional dimension could represent some intrinsic property of the oscillator, such as its energy, amplitude, or phase in that dimension.

Implementation in Code (Bash):

```
#!/bin/bash

# Definition of frequencies in each dimension (example)
freq_x=10 # Frequency in dimension x
freq_y=20 # Frequency in dimension y
freq_z=30 # Frequency in the z dimension
freq_time=40 # Frequency in the time dimension
freq_property=50 # Frequency in the additional dimension

# Simulation of the oscillator in 5 dimensions
simulate_5d_oscillator() {
    time=0
    while true; do
        # We calculate the position in each dimension using the frequency
and time
        pos_x=$(echo "s($freq_x * $time)" | bc -l)
        pos_y=$(echo "s($freq_y * $time)" | bc -l)
        pos_z=$(echo "s($freq_z * $time)" | bc -l)
        property=$(echo "s($freq_property * $time)" | bc -l)

        # We print the coordinates in each dimension
        echo "Time: $time, Position (x, y, z): ($pos_x, $pos_y, $pos_z),
Property: $property"

        # We increased the time to advance in the simulation
        time=$(echo "$time + 0.1" | bc -l)

        # We break the loop if the time exceeds a certain limit
        if [ $(echo "$time > 10" | bc -l) -eq 1 ]; then
            break
        be
    done
}

# We call the function to simulate the oscillator in 5 dimensions
simulate_5d_oscillator
```

The basics of the script steps: In this Bash script, we define the frequencies in each dimension and then simulate the behavior of the oscillator in an infinite loop. At each iteration of the loop, we calculate the position of the oscillator in each dimension using the trigonometric (sine in this case) functions of the frequencies and time. Finally, we print the coordinates in each dimension along with the time and the property associated with the oscillator. The loop stops when the time exceeds a certain limit (in this case, 10 time units).

Lighting Aircraft Concept in 5 Dimensions:

Engineering, collections

A 5-dimensional light aircraft is a hypothetical entity that moves at superluminal speeds in five-dimensional space. This aircraft has a structure that can be represented by a matrix in which each entry corresponds to a point in space. The position and orientation of the aircraft in space are determined by this matrix.

Matrix Representation of the Luminous Aircraft:

In a matrix representation, the light aircraft can be divided into several components, such as the fuselage, wings, engines, etc. Each component can be represented by a 3D matrix that describes its shape and relative position with respect to the center of the aircraft. These matrices are combined to form the final three-dimensional matrix that represents the complete aircraft.

Explanation of Previous Steps:

1. **Definition of Components**: Identify the different components that make up the light aircraft, such as the fuselage, wings, engines, etc.
2. **Matrix Representation of Components**: For each component, define a three-dimensional matrix that describes its shape and relative position with respect to the center of the aircraft.
3. **Matrix Combination**: Combine the matrices of the different components to form a three-dimensional matrix that represents the complete aircraft.
4. **Simulation and Visualization**: Use programming tools such as Python and libraries such as NumPy and Matplotlib to simulate and visualize the aircraft in a five-dimensional space.

Example of Implementation in Python:

```
import numpy as np
import matplotlib.pyplot as plt

# Definition of matrices for aircraft components
# For simplicity, example arrays are shown

# Fuselage
fuselage = np.ones((10, 3, 3)) # Example: fuselage as a cube

# Alas
wings = np.zeros((4, 3, 5)) # Example: wings like cobblestones

# Engines
engines = np.zeros((2, 2, 2)) # Example: engines as small cubes

# Combination of the component matrices to form the three-dimensional matrix
of the aircraftand
aircraft = np.zeros((20, 20, 20)) # Total size of the aircraft array
aircraft[0:10, 0:3, 0:3] = fuselage
```

```
aircraft[5:9, 3:6, 0:5] = wings
aircraft[2:4, 2:4, 0:2] = engines

# Visualization of the three-dimensional matrix that represents the aircraft
plt.figure()
plt.imshow(aircraft[:, :, 10], cmap='gray') # Display in one dimension (slice display)
plt.title('Light Aircraft in 5 Dimensions')
plt.axis('off')
plt.show()
```

1. **Definition of the 5D Aircraft Matrix**:
   - The function `generate aircraft 5d(dim)` creates a 5D matrix that represents the structure of the light aircraft.
   - **5D Matrix Visualization**:
   - The function `view 5d aircraft(aircraft)` Projects the 5D matrix into 3D space to visualize the aircraft structure. The projection is performed using one of the additional dimensions, in this case, the fourth and fifth dimensions are set to a specific value to simplify the visualization.
2. **Creating and Executing the Python Script**:
   - The Bash script creates a Python file containing the functions defined above and runs it to generate and display the 5D array of the light aircraft.

Superluminal Oscillator Concept

A superluminal oscillator is a system that moves at speeds faster than the speed of light in a theoretical space of multiple dimensions. In today's physics, this is a theoretical concept, since, according to the theory of relativity, nothing can exceed the speed of light in a vacuum. However, for purposes of simulation and mathematical representation, we can model a system that behaves in this way.

Integration of Oscillator Frequencies in the Model

We can integrate oscillator frequencies into the model by adjusting the aircraft matrix so that positions change based on an oscillatory frequency in each dimension. This can be represented in the code by adding sinusoidal oscillation terms.

Conclusions from the computational research:

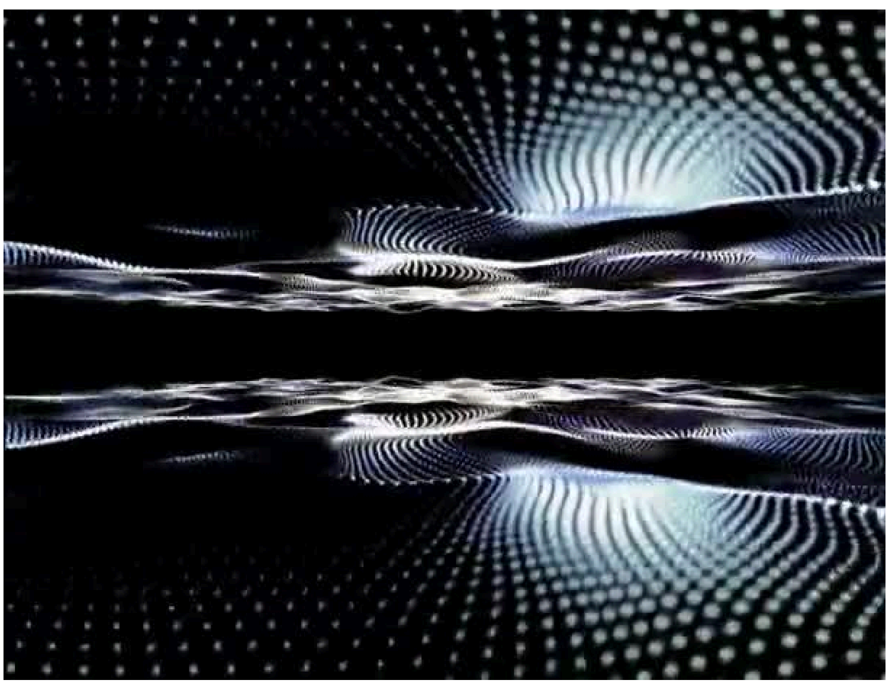
The theory of multiple nodes or networks can be valid for calculating angles or different dimensions of stars, especially if we consider each node as a data point in a multidimensional space that represents a specific characteristic of a star or galaxy. Connecting nodes with parameters in Linux over galaxies is a way to apply network and graph analysis techniques to astronomy. This approach can help you model, analyze and visualize complex relationships between astronomical objects.

Theory of Nodes and Networks in Multiple Terminals

In the context of astronomy and theoretical physics, nodes can represent celestial objects (such as stars, planets, or galaxies) and the edges (connections) between them can represent relationships or interactions between these objects, such as gravitational forces, relative distance, or angular alignments.

Linux Implementation to Calculate Angles and Dimensions of Stars

We can use Bash scripts along with graph analysis tools in Python (such as NetworkX) to model and analyze these networks.



Concept of Node Networks in Astronomy

This methodology is valid for:

- **Galaxy Network Analysis**: Model and analyze the interactions between galaxies in a cluster.
- **Simulation of Stellar Dynamics**: Understand how stars interact and influence each other in a star cluster.
- **Spatial Geometry Exploration**: Calculate angles and distances between celestial objects to study the structure of the universe.

Orchestration

Orchestration is a key concept for managing these large-scale simulations and analyses. Using tools like Docker Swarm, you can deploy and manage your analytics applications on multiple nodes, ensuring high availability and scalability.

Orchestration Implementation

For a more advanced setup, you could use Docker Swarm to deploy analytics services to multiple nodes. This implies:

- **Swarm Mode Settings**: Initialize a Swarm and add nodes as managers and workers.
- **Service Deployment**: Create Docker services that run your analysis and visualization scripts.
- **Management and Scalability**: Use Docker Swarm to manage availability and scale services as needed.

This approach allows you to automate and scale the analysis of large volumes of astronomical data, improving the efficiency and reliability of your research.

Conclusion

Using multiple nodes and networks, you can model and analyze complex interactions and structures in astronomy, connecting astronomical parameters and data in a Linux environment. Integration with orchestration tools such as Docker Swarm allows these analyzes to be scaled and managed efficiently, improving the ability to discover and understand cosmic phenomena.

Software and code in nodes; Docker Swarm for Dimensional Star Analysis

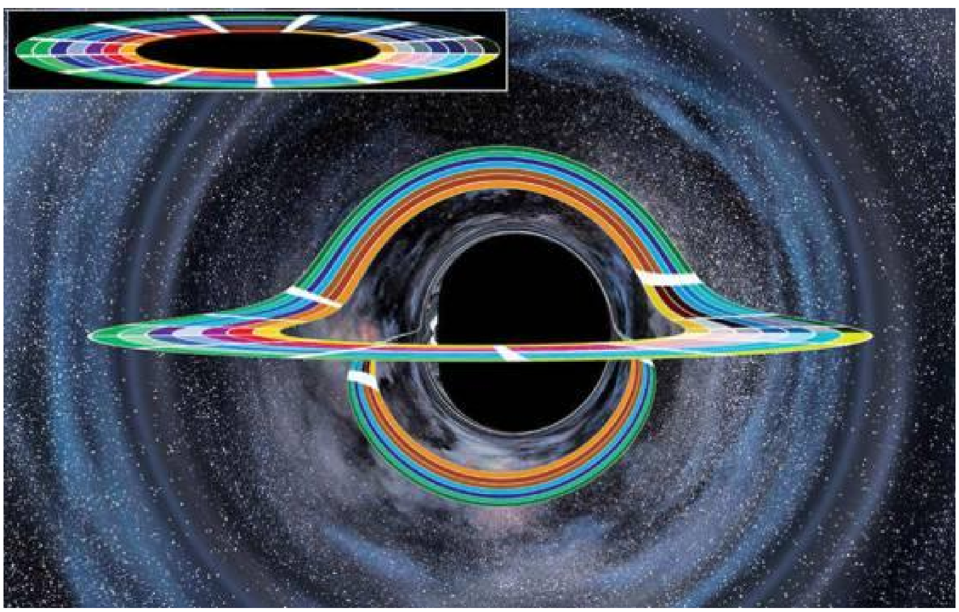
Docker Swarm allows you to manage and orchestrate a cluster of Docker containers, distributing the workload across multiple nodes to improve scalability and availability. This is especially useful for data-intensive analyses, such as multidimensional analysis of cosmic phenomena.

Steps to Configure and Use Docker Swarm

Engineering, collections

1. **Docker Swarm configuration**: Initialize a Swarm and add nodes.
2. **Service Deployment**: Run Docker containers that perform the analysis.
3. **Scalability and Management**: Use Swarm capabilities to scale services based on workload.

Black hole image:



Example of Nodes for Different Galaxies

To represent the characteristics of each galaxy and its stars, each cluster node can have specific configurations to simulate different interplanetary parameters and galaxy nodes. Three nodes with different configurations are described below.

Node 1: Analysis of the Andromeda Galaxy

- **CPU**: 16

vCPUs

- **RAM**: 64 GB
- **Disco**: 1 TB SSD
- **Tasks**: Analysis of giant and supergiant stars, distribution of dark matter, orbital parameters of binary systems.

Node 2: Analysis of the Milky Way

- **CPU**: 32 vCPUs
- **RAM**: 128 GB
- **Disco**: 2 TB SSD
- **Tasks**: Analysis of the spiral structure, dynamics of star clusters, simulations of supernovae and black holes.

Node 3: Analysis of the Triangular Galaxy (M33)

- **CPU**: 24 vCPUs
- **RAM**: 96 GB
- **Disco**: 1.5 TB SSD
- **Tasks**: Analysis of star formation, gravitational interactions with nearby galaxies, distribution of interstellar gas and dust.

Each node can be dedicated to a specific set of analyses, allowing for efficient work segmentation and optimal resource management.

```
# A node1 (Manager)
docker swarm init --advertise-addr 192.168.1.1

# And node2, node3 (Workers)
docker swarm join --token SWMTKN-1-xyz 192.168.1.1:2377
```

Andromeda Galaxy:

```
import numpy as np

def analyze_andromeda():
    stars = np.random.rand(1000, 5)
    centroid = np.mean(estrellas, axis=0)
    print(f"Andromeda centroid in 5D: {centroid}")

if __name__ == "__main__":
    analyze_andromeda()
```

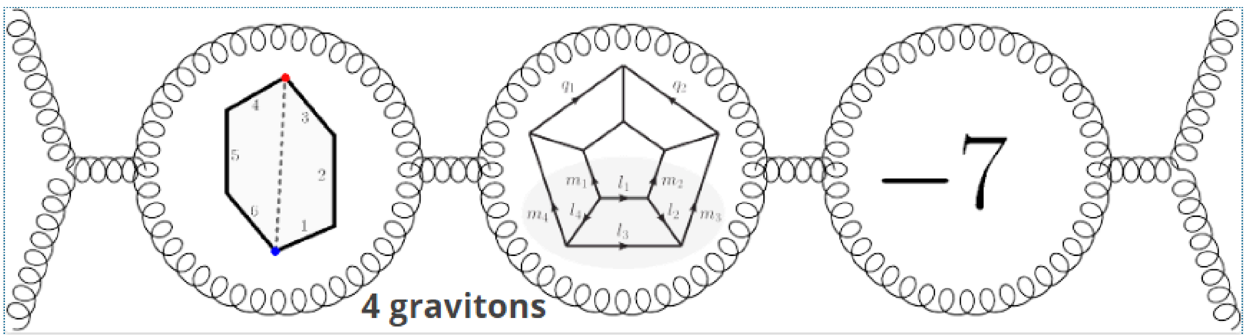
Conclusion

Engineering, collections

Docker Swarm provides a flexible and scalable infrastructure for performing multidimensional analysis of cosmic phenomena. Using specific nodes for different galaxies, each with their own configurations and tasks, it is possible to efficiently manage large volumes of data and complex astrophysical simulations. This configuration allows a deep and detailed analysis of interplanetary parameters, stellar structures and galactic dynamics.

Structure of quantum superluminal particles

(notes on quantum cryptography, underlined notes and formulas)



Example:

Definition 0.2.3 — Standard basis. Consider the 2-dimensional complex vector space C
2.
The standard basis, or sometimes known as the computational basis, S = {|0i,|1i} is an orthonormal basis for this vector space, where the basis vectors are

|0i =10 and |1i =01.

Multiple qubits

Classically, if we have two bits, we write them as ’00’, ’01’ and so forth. But how can we write two qubits? One strategy is to again associate each of the two classical bits x1, x2 ∈ {0,1}
2 with a vector. Labeling the first qubit A and the second one B, we could perform the mapping from strings to orthonormal vectors as

0A0B → |00iAB =1000

0A1B → |01iAB =0100

1A0B → |10iAB =0010

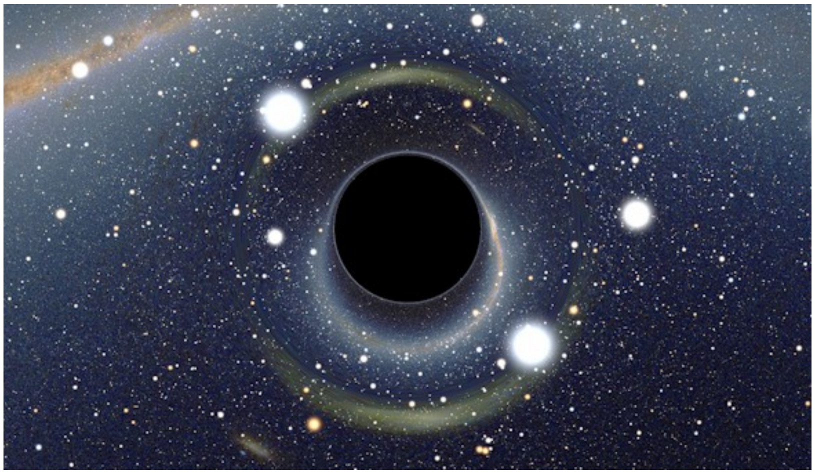
1A1B → |11iAB =0001

Note that the resulting vectors are in C d with dimension d = 2 & 2 = 4, where the dimension corre-sponds to the number of possible strings. It turns out that one can write a two-qubit state |ψiAB ∈ C4 as a superposition of these vectors, where we again demand that |ψABi is normalized. As an example, let us consider a state |ψABi that is an equal superposition of all the above standard basis

Vectors:

|ψiAB =
1
2
|00iAB +
1
2
|01iAB+
1
2
|10iAB+
1
2
|11iAB (20) =121000+120100+120010+120001(21) =121111.

$$\begin{aligned}\langle\text{EPR}|\text{EPR}\rangle_{AB} &= \frac{1}{\sqrt{2}}(\langle 00|_{AB} + \langle 11|_{AB}) \cdot \frac{1}{\sqrt{2}}(|00\rangle_{AB} + |11\rangle_{AB}) \\ &= \frac{1}{2}(\underbrace{\langle 00|00\rangle_{AB}}_{1} + \underbrace{\langle 00|11\rangle_{AB}}_{0} + \underbrace{\langle 11|00\rangle_{AB}}_{0} + \underbrace{\langle 11|11\rangle_{AB}}_{1}) \\ &= \frac{1}{2}\cdot 2 = 1, \qquad \Longrightarrow \qquad \sqrt{\langle EPR|EPR\rangle} = 1.\end{aligned}$$



Definition 0.7.1 The parametrization (θ, ϕ) of

$$|\psi\rangle = e^{i\gamma}\left(\cos\frac{\theta}{2}|0\rangle + e^{i\phi}\sin\frac{\theta}{2}|1\rangle\right) \tag{123}$$

is called the *Bloch sphere representation* (Figure 2) and a qubit can be described by a *Bloch vector* $\vec{r} = (\cos\phi\sin\theta, \sin\phi\sin\theta, \cos\theta)$.

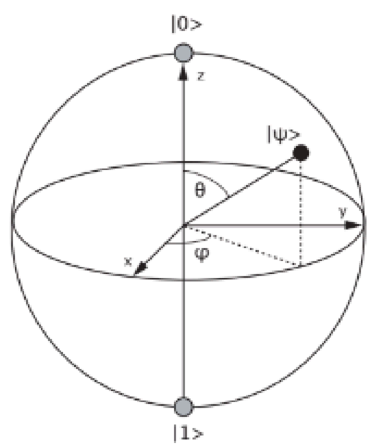


Figure 2: Bloch Sphere

Definition 0.2.5 — Standard basis for n qubits. Consider the state space of n qubits C
D, where d = 2n. For each distinct string x ∈ {0,1}
n, associate x with a distinct integer i ∈ {1,2,···d}. The standard basis for C d is an orthonormal
basis given by Sn = {|xi}x∈{0,1} n ,

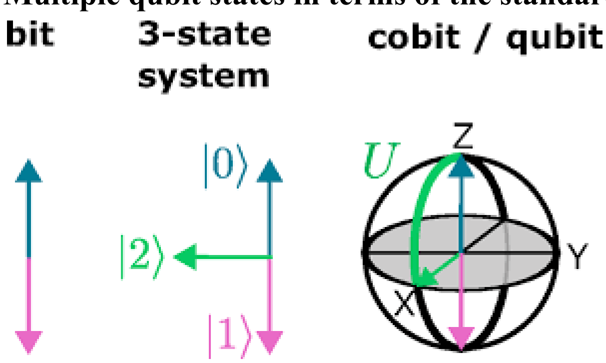
|xi =

0
.
.
.
1
.
.
.
0
−→ i-th position.

This basis can be constructed, by taking the tensor product of standard basis elements for individual qubits: |0iA ⊗|0iB,|0iA ⊗|1iB,|1iA ⊗|0iB,|1iA ⊗|1iB

$$|00\rangle_{AB} = \begin{pmatrix}1\\0\\0\\0\end{pmatrix}, \ |01\rangle_{AB} = \begin{pmatrix}0\\1\\0\\0\end{pmatrix}, \ |10\rangle_{AB} = \begin{pmatrix}0\\0\\1\\0\end{pmatrix}, \ |11\rangle_{AB} = \begin{pmatrix}0\\0\\0\\1\end{pmatrix}.$$

Multiple qubit states in terms of the standard basis,



|+iA
|+iB =12(|0iA +|1iA)(|0iB +|1iB) = 12
(|00 iAB +|10 iAB +|01 iAB +|11iAB) (47)

|−iA

|−iB =12(|0iA −|1iA)(|0iB −|1iB) = 12
(|00 iAB −|10 iAB −|01 iAB +|11 iAB). (48)

These are computational structures where a set of dimensions and extreme states appear that behave like dimensions of 9D or more at quantum speeds and in types of quantum gravity where the concept of space is very different, portals appear, mirrors that are like frequencies practically invisible that change the speed of objects that are within another dimension at the frequency level. There is the possibility of magnetic portals that are structured with quantum gravity and that make up many of the structures that we could find in the universe.
The states and structures of superluminal particles must be attempted to be drawn on larger scales of understanding. The theory points to the basis that the transpositions of states of superluminal particles could be found within a set of subdimensions that are
They unfold just like a mirror composed of different quantum radio frequencies with quantum gravity types.

Application: Randomness from a deterministic process Can we do anything interesting with what we have learned so far? It turns out the answer is yes: by preparing just single qubits and measuring in the standard basis, we can in principle achieve a task that is impossible classically. Namely, we can produce true random numbers. Consider the following process illustrated in Figure 1: first, prepare a qubit in the state

|+i = √12 (|0i+|1i).

Next, measure this state in the standard basis:

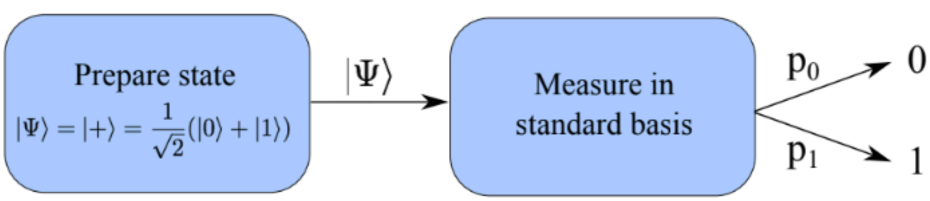


Figure 1: Generation of genuine randomness from the preparation of a qubit in superposition.

be calculated by evaluating the inner products:

$$p_0 = |\langle +|0\rangle|^2 = \left|\frac{1}{\sqrt{2}}(\langle 0| + \langle 1|)\,|0\rangle\right|^2 = \left|\frac{1}{\sqrt{2}}(\underbrace{\langle 0|0\rangle}_{1} + \underbrace{\langle 1|0\rangle}_{0})\right|^2 = \frac{1}{(\sqrt{2})^2} = \frac{1}{2}, \quad (54)$$

$$p_1 = |\langle +|1\rangle|^2 = \left|\frac{1}{\sqrt{2}}(\langle 0| + \langle 1|)\,|1\rangle\right|^2 = \left|\frac{1}{\sqrt{2}}(\underbrace{\langle 0|1\rangle}_{0} + \underbrace{\langle 1|1\rangle}_{1})\right|^2 = \frac{1}{(\sqrt{2})^2} = \frac{1}{2}. \quad (55)$$

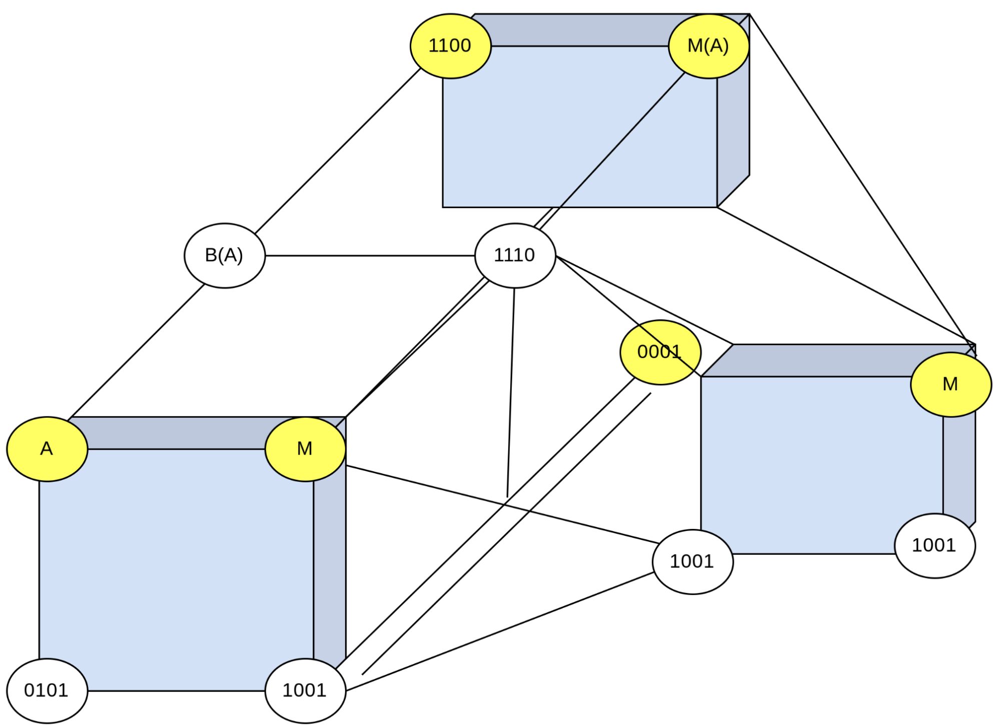
Engineering, collections

Remember that the elements of the standard basis are orthonormal:

(|0i)†|0i = (1 0)10= 1 ,

(|0i)†|1i = (1 0)01= 0 .

A particle state diagram

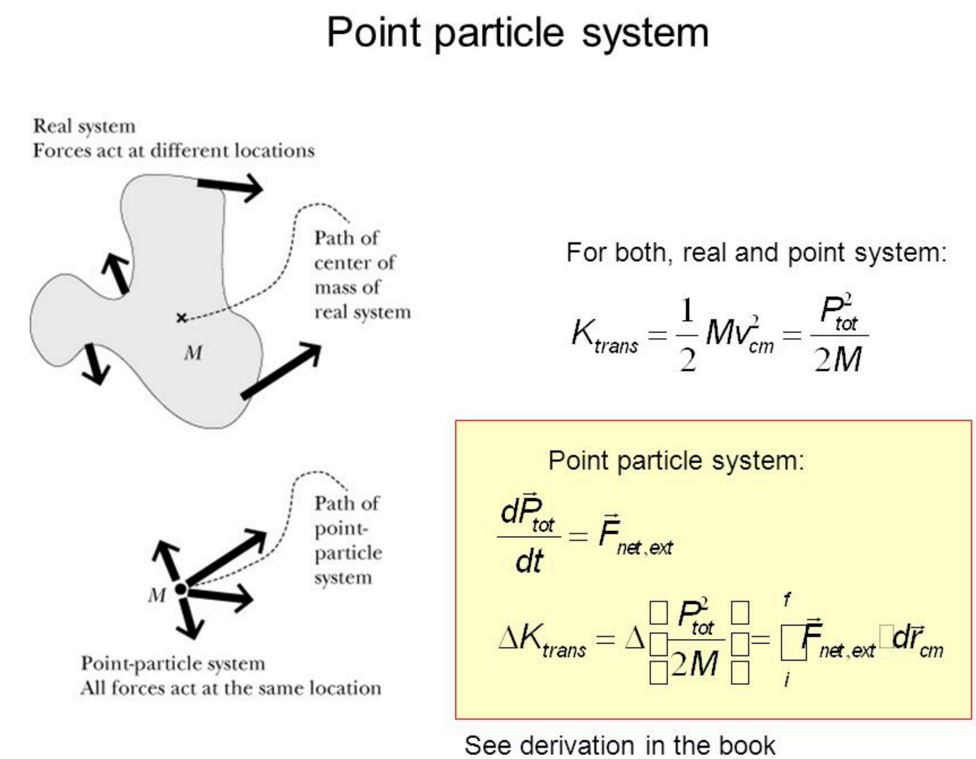


States of qubits (Mapping states in the following algorithm..)

$$p_+ = |\langle\Psi|+\rangle|^2 = \left|\frac{1}{2}(\langle 0| - i\langle 1|)(|0\rangle + |1\rangle)\right|^2 \tag{71}$$
$$= \frac{1}{4}\left|\langle 0|0\rangle + \langle 0|1\rangle - i\langle 1|0\rangle - i\langle 1|1\rangle\right|^2 \tag{72}$$
$$= \frac{1}{4}|1-i|^2 \tag{73}$$
$$= \frac{1}{4}(1-i)(1+i) = \frac{1}{2}, \tag{74}$$
$$p_- = |\langle\Psi|-\rangle|^2 = \left|\frac{1}{2}(\langle 0| - i\langle 1|)(|0\rangle - |1\rangle)\right|^2 \tag{75}$$
$$= \frac{1}{4}\left|\langle 0|0\rangle - \langle 0|1\rangle - i\langle 1|0\rangle + i\langle 1|1\rangle\right|^2 \tag{76}$$
$$= \frac{1}{4}|1+i|^2 \tag{77}$$
$$= \frac{1}{4}(1+i)(1-i) = \frac{1}{2}, \tag{78}$$

Example 0.4.5 Consider a qutrit, which is a 3-dimensional quantum system represented by the vector

|vi =1√2100 +12010+12001, and measure in the basis B = {|b1i,|b2i,|b3i} where
|b1i =100
, |b2i =1√2011
, |b3i =1√201−1.



Measuring multiple systems

We saw how to measure some quantum state |ψi. Let us now consider what happens if we measure the state of multiple qubits, where we think of measuring each qubit in a separate basis. To understand this, it is useful to realize that a basis for the joint state space CdA A ⊗CdBB can be obtained from bases for the individual state spaces CdAA and C dB B.

Given two vectors $|v_1\rangle = \begin{pmatrix} a_1 & \cdots & a_d \end{pmatrix}^T$ and $|v_2\rangle = \begin{pmatrix} b_1 & \cdots & b_d \end{pmatrix}^T$,

1. **(Inner product)** $\langle v_1|v_2\rangle := \langle v_1||v_2\rangle = \sum_{i=1}^{d} a_i^* b_i$.
2. **(Tensor Product)**

$$|v_1\rangle \otimes |v_2\rangle := \begin{pmatrix} a_1b_1 & a_1b_2 & \cdots & a_1b_d & a_2b_1 & \cdots & a_2b_d & \cdots & a_db_d \end{pmatrix}^T.$$

Commonly used orthonormal bases for qubits

Standard basis for 1 qubit: $\mathscr{S} = \{|0\rangle, |1\rangle\}$ where $|0\rangle = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$ and $|1\rangle = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$.

Standard basis for n qubits: $\mathscr{S}_n = \{|x\rangle\}_{x\in\{0,1\}^n}$ where for any string $x = x_1x_2\cdots x_n$, $|x\rangle = |x_1\rangle \otimes |x_2\rangle \otimes \cdots \otimes |x_n\rangle$.

Hadamard basis for 1 qubit: $\mathscr{H} = \{|+\rangle, |-\rangle\}$ where $|\pm\rangle = \frac{1}{\sqrt{2}}(|0\rangle \pm |1\rangle)$. Since these are orthonormal bases, the following holds:

$$\langle 0|1\rangle = \langle 1|0\rangle = 0, \qquad \langle 0|0\rangle = \langle 1|1\rangle = 1, \tag{125}$$

$$\langle +|-\rangle = \langle -|+\rangle = 0, \qquad \langle +|+\rangle = \langle -|-\rangle = 1, \tag{126}$$

$$\langle x|x'\rangle = \delta_{xx'}, \text{ where } x, x' \in \{0,1\}^n \text{ and } \delta_{xx'} \text{ is the Kronecker-delta function.} \tag{127}$$

Common representations of a qubit

Standard representation: $|\psi\rangle = \alpha|0\rangle + \beta|1\rangle$, where $\alpha, \beta \in \mathbb{C}$.

Bloch sphere representation: $|\psi\rangle = e^{i\gamma}\left(\cos\frac{\theta}{2}|0\rangle + e^{i\phi}\sin\frac{\theta}{2}|1\rangle\right)$, where $\gamma, \theta, \phi \in \mathbb{R}$.

Properties of the tensor product

For any $|v_1\rangle, |v_2\rangle$ and $|v_3\rangle$,

1. Distributive: $|v_1\rangle \otimes (|v_2\rangle + |v_3\rangle) = |v_1\rangle \otimes |v_2\rangle + |v_1\rangle \otimes |v_3\rangle$
   Also, $|v_1\rangle \otimes (|v_2\rangle + |v_3\rangle) = |v_1\rangle \otimes |v_2\rangle + |v_1\rangle \otimes |v_3\rangle$.
2. Associative: $|v_1\rangle \otimes (|v_2\rangle \otimes |v_3\rangle) = (|v_1\rangle \otimes |v_2\rangle) \otimes |v_3\rangle$.

Similarly, these relations hold for any $\langle v_1|, \langle v_2|$ and $\langle v_3|$.

Probability of measurement outcomes

Consider measuring a quantum state $|\Psi\rangle$ in an orthonormal basis $\mathscr{B} = \{|b_i\rangle\}_{i=1}^{d}$. The probability of measuring a particular outcome "b_i" is $p_i = |\langle\Psi|b_i\rangle|^2$. After the measurement, if a certain outcome "b_i" is observed, then the state $|\Psi\rangle$ has collapsed to $|b_i\rangle$.

Pauli matrices

The Pauli matrices are 2×2 matrices,

$$X = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}, \quad Z = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}, \quad Y = iXZ, \tag{128}$$

The Pauli matrices, commonly denoted as X,Y,Z. These are quite famous in physics, but also have rather interesting interpretations as bit and phase flip operations as we will see below. The Pauli matrices are unitary 2×2 matrices, with the following form

X = 0 11 0 , (104)

WITH =1 0 0 −1, (105)
AND = iXZ.

Definition 0.5.1 — Identity. The identity $\mathbb{I}$ is a diagonal, square matrix where each diagonal element is equal to 1, i.e.

$$\mathbb{I} = \begin{pmatrix} 1 & 0 & \cdots & \cdots & 0 \\ 0 & 1 & \cdots & \cdots & 0 \\ \vdots & \vdots & \ddots & \ddots & \vdots \\ 0 & 0 & \cdots & 0 & 1 \end{pmatrix}. \quad (93)$$

[4]Remember that $(U|\psi\rangle)^\dagger = \langle\psi|U^\dagger$.

The Pauli-X matrix acts on the standard basis vectors by interchanging them:

X |0i = |1i , (107)
X |1i = |0i . (108)

The Pauli-Z matrix has the effect of interchanging the vectors |+i and |−i.

- Z |+i = Z(|0i+|1i)/
- √2 = (Z |0i+Z |1i)/
- √2 = (|0i−|1i)/
- √2 = |−i. (111)

(End of section)

The search for black holes:

The development of X-ray astronomy provided the first evidence of the existence of black holes in the Galaxy. In 1962 a V2 rocket equipped with a detector **X-ray** detected the first source outside the solar system in this range of the electromagnetic spectrum, **Scorpius X-1** (or Sco X-1, Giacconi et al. 1962); It was later determined that **Sco X-1** It is a neutron star orbiting a normal star. Two years later, the first candidate for a galactic black hole was detected, which is part of the binary system **Cygnus X-1** [Bowyer et al., 1965]. Since a large part of the X-rays that reach Earth are absorbed in the atmosphere, high-energy astronomy took a great leap when detectors were placed on satellites. The first of its kind in the X-ray range was the Uhuru Satellite, launched by the **NASA** in 1970 [Giacconi et al., 1974]. In the following years, Various satellites allowed surveys of the entire sky, detecting numerous sources of X-rays. **1975** the **NASA** launched an X-ray satellite, Small Astronomy Satellite 3 (SAS-3), which operated for 4 years. The data collected by this instrument made it possible to associate the pulsating X-ray sources with neutron stars.

Radiation in black holes: A direct consequence of the difference between the proper time (usually denoted by the letter τ) and the time measured by an external observer is that the radiation coming from a given $r > rSchw$ will be red-shifted when detected by a static and distant observer. Since the frequency (and therefore energy) of the photon depends on the time interval, a photon will need “infinite” energy to escape from the interior of the region determined by Schwep. Events that occur at $r < rSchw$ will be disconnected from the rest of the universe. Therefore, to the surface determined by **r = rSchw** It is called the event horizon: that which cross the event horizon you can never get out again. The black hole is the region of space-time within the event horizon.

Fig 5

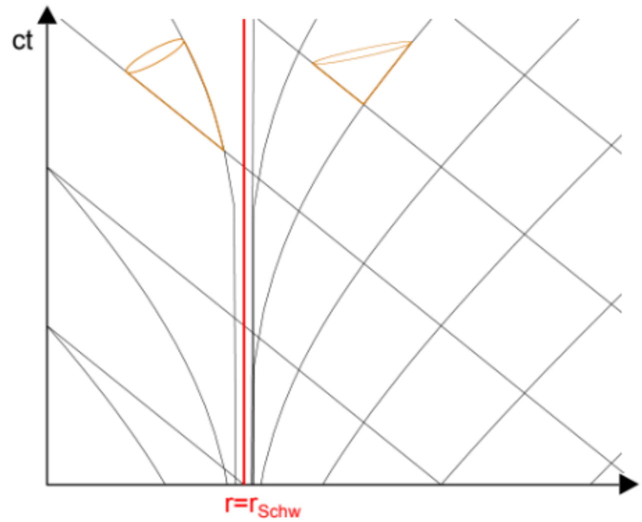


Fig. 5 is the Schwarzschild spacetime diagram in Eddington-Finkelstein coordinates. It can be seen that the surface at r = Schw is a null surface. This null surface is an event horizon because within r = rSchw all light cones have r = 0 in the future. The object at r = 0 is the source of the gravitational field and is called the singularity. Everything that crosses the event horizon ends in the singularity.

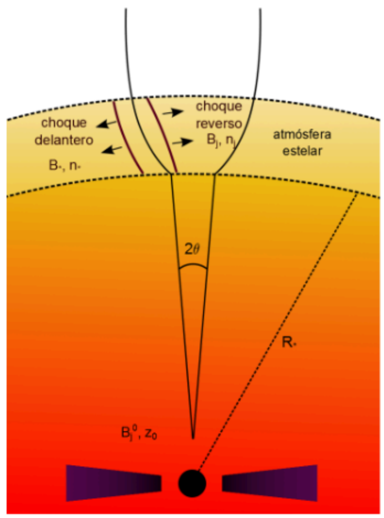
GAMMA RAY ERUPTIONS

The most discussed model that explains the origin of the initial emission of gamma rays is the internal shock model. **[Rees & Meszaros, 1994]**. In this model, the central source ejects collimated shells of material that propagate through the interior of the star. As they propagate, the luminescent high dimensions accumulate stellar material in the front, so their speed decreases. Different layers are emitted intermittently; Since the layers or dimensions of a possible stellar luminescence that move behind have a higher speed, the different layers collide with each other, creating internal collisions. The particles are accelerated to relativistic energies in these collisions. However, the standard version of this model does not explain the origin of the magnetic field necessary to produce the radiation of synchrotron components (synchrotron particle).

Spectral characteristics in WR type stars:
The presence of spectral features typical of WR stars in the afterglow emission favors these stars as the progenitors of collapsors [e.g., Piro et al., 2000; Mirabal et al.,2002]. In this model the progenitor is considered to be a radio star WR **R* = 1012 cm**. The exact value of the star's mass has no direct effect on the calculations, and only modifies the duration of the **GRB**. The collapse

of the core is considered to leave a black hole of initial mass **MBH = 10M** , surrounded by an accretion disk.

2.1 Schematic diagram of the jet model, along with the structure
double shock.



In the jet reference frame, the density of particles within the
jet is characterized at a structural and mathematical level (variables) by:

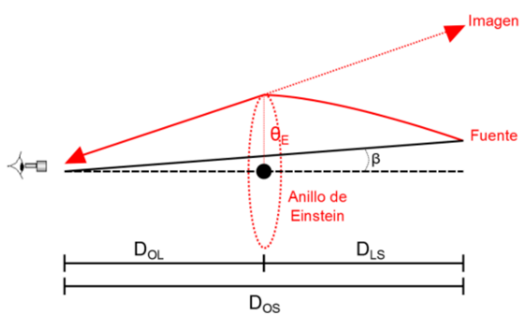
him/her = Liso 4πz2Γ
2
j mpc
3
.

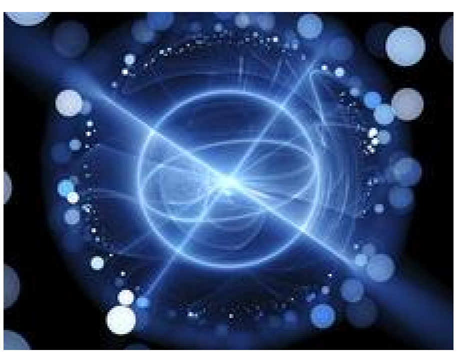
Gamma emission values and ranges:
The values inferred from gamma emission observations are in
the rank of 100 < Γ < 103

Effect of gravitational lensing on neutrino flux:

It could also be noted that aerodynamics and airfoils can be considered within the field of quantum particles and neutrino flux emphasizing the idea of constructing particular quantum models or structures together with the engineering of hole Riemann tensors. blacks at a level of dimensions and structures in each galaxy, and provide explanation through hardware bases and quantum computing and quantum optics. But the interesting thing at this point is that the effect of gravitational lenses offers a possible explanation for a next step of quantum particles that are the portals or quantum mirrors or quantum frequencies present in the universe.

Gravitational lensing is a phenomenon that results from the deflection of a signal by a gravitational field [Einstein, 1936]. The magnification of the neutrino signal by gravitational lensing of nearby supermassive black holes is studied. The mass of neutrinos is very low (mvc 2 eV), so they follow, to a good approximation, null geodesics [Eiroa & Romero, 2008]. The application to gamma ray eruptions is also considered of a point source of neutrinos, with a distance to the observer Two, behind a lens caused by a Schwarzschild black hole, at a distance Dol. The distance between the lens and the source is Dls.





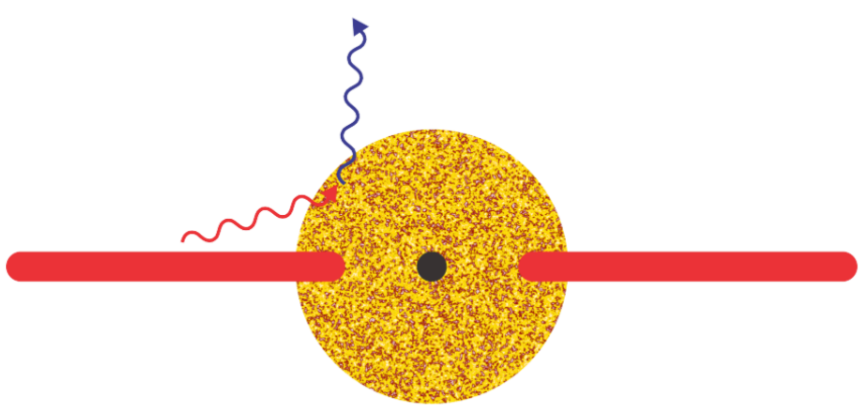
Galaxia	Distancia [Mpc]	Masa del agujero negro [$10^8 M_\odot$]	θ_E [arcsec]
Vía Láctea	0,0085	0,03	1,64
NGC0224	0,7	0,3	0,59
MESSIER094	4,6	0,75	0,36
NGC3115	8,4	20,0	1,39
NGC4486	15,3	33,0	1,32
NGC5846	29,1	5,37	0,38
NGC5850	35,0	2,68	0,25
NGC6500	41,1	1,41	0,17
NGC7469	67,0	4,96	0,27
UGC00600	93,3	2,06	0,13

The distances are very large compared to the Schwarzschild radius of the black hole and the angles are measured from the observer. The angular position of the source, β, is small when the alignment is high. For this configuration, two weakly deflected images and two sets of infinitely strong strongly deflected images are formed (also called relativistic, Virbhadra & Ellis 2000). Typical distances between deflected images are on the order of the Einstein radius.

```
Rs = 2MG/c2 is the Schwarzschild radius of the lens. When
β = 0, instead of two images, an Einstein ring of
radio θE.
```

Sombrero

This geometry is a combination of a homogeneous spherical corona of radius Rc and an accretion disk that penetrates only up to a certain radius Rd into the corona (Rd < Rc)

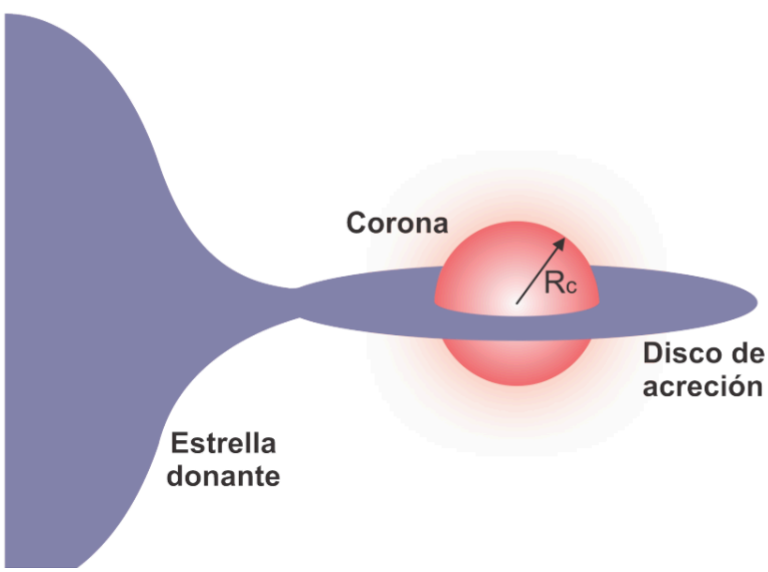


Black hole inner radius disk and coronal radiation:

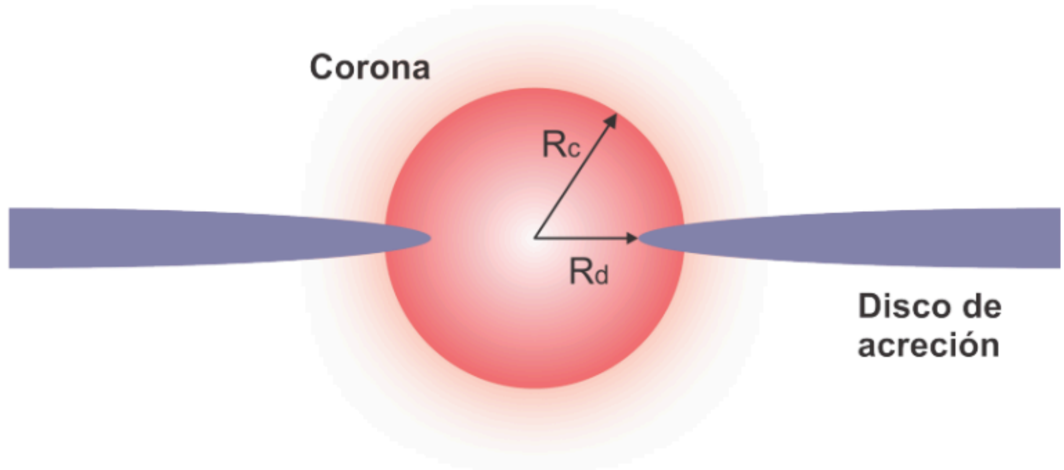
The accretion disk penetrates the corona up to an internal radius $Rd < Rc$, with **Rd/Rc** ~ **0,9**; This is a typical value on models where the disc is the main source of seed photons for Comptonization [Poutanen, 1998; Haardt & Maraschi, 1993]. The existence of other sources of photons allow the value of this quotient to be relaxed.

LH. The **XRVs** with well-differentiated coronas in the LH state usually produce relativistic jets. In this way, the power of the jet is related to the magnetic field of the source. For Cygnus X-1 and other similar systems, the kinetic power of the jet is approximately equal to the luminosity of the corona Lc; In this way, the average value of the magnetic field B can be estimated by equipartition between the magnetic energy density and the volumetric photon density in the corona (see, for example, Bednarek 2000),

$+B2\ 8\pi = Lc\ 4\pi R2cc.$



Schematic representation of the system components; he
accretion disk penetrates the corona up to an internal radius Rd < Rc.



(b)

Magnetic fields and particles:

If the magnetic field launches the plasma in the form of a jet, it is reasonable to assume that there are structures of dimensions between model structures within the framework of the magnetic energy density and the kinetic energy density of the plasma; This allows the density of the plasma to be estimated. The photon field of the accretion disk is represented as a black body of fixed temperature. Both this field and the hard photon field of the corona are considered targets for relativistic particle interactions.

The acceleration mechanism of particles in coronas is probably related to magnetic reconnection. A temperature of Ti ions is adopted ~ 1012 K, while that of the electrons is **The = 109K**, considerably lower than that of ions [e.g., Narayan & Yi, 1995a,b].

The maximum power available to inject relativistic particles can be estimated from the following variable structure:

$$\boxed{L = B2\ 8\pi AvA,}$$

Powers and constants of Q0 or radioactive energy:

The power law index is in the range **1 6 C 6 3**. The normalization constant Q0 can be obtained once the fraction of the total power is fixed **variable:** qrl, which is injected into relativistic particles. The way energy is distributed between hadrons and leptons is not known; To deal with this uncertainty, the parameter a is defined as the relationship between the power injected in protons and that injected in electrons, **a = Lp/Le**. This is one of the free parameters of the Model. In this model, the acceleration mechanism is not included because it is an energy gain term in the transport equation, but is used to fix the injection function of primary electrons and protons, and to determine the maximum energies that relativistic particles can reach.

Inverse Compton scattering or IC: is an elastic scattering of a photon by a charged particle; In this interaction, a low-energy photon interacts with a relativistic particle, which gives it part of its energy. The interaction can be schematized in the form

and − + γ → e − + c.

Synchrotron radiation: it is the electromagnetic radiation that re-
results from the acceleration of a charged particle in a magnetic field, that is,

and − + B → e − + B + c.

The relativistic protons injected into the corona interact with
the source fields, and produce π mesons

0 , p + y p

Engineering, collections

The following particle structures are given through the following interactions:

Inelastic proton-proton collisions: interactions between hadrones and the source matter field. The interaction channels are:

p + p → p + p + ζ1π
0 + ζ2(p
+ + p
−),

p + p → p + n + π
+ + z1p
0 + ζ2(p
+ + p
−),

p + p → n + n + 2π+ + ζ1π
0 + ζ2(p
+ + p
−),

(4.13)

where ζ1 and ζ2 are the multiplicities.

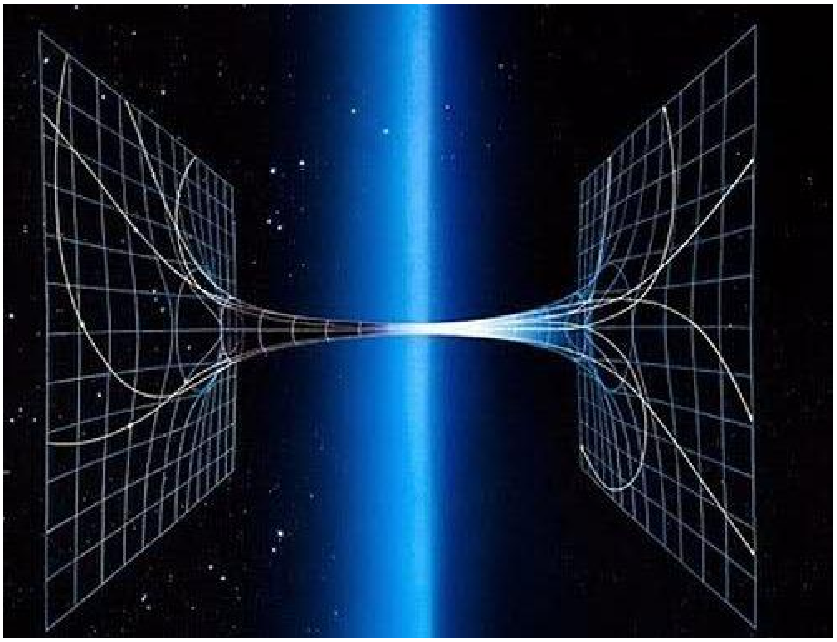
At energies lower than the threshold for pion creation, the main channel for proton-photon interaction is the production of electron-positron pairs,

p + γ → p + e
+ + and

The neutral pions that are injected by these interactions have a half-life time of 8.4×10^{-17} s, and then decay generating two photons,

p
0 → γ + γ

Thus, inelastic proton-proton (pp) collisions and interactions photohadronics (pγ) are terms of energy losses for the protons, and the decay of the π 0 contributes to the total luminosity. On the other hand, protons also lose energy due to synchrotron, since they are charged particles that interact with the magnetic field.



Muons are charged leptons, so they lose energy through of the same channels as relativistic electrons. The muons decay according to the following mathematical structure:

m
− → and
− + nm + ne,
m
+ → and
+ + nm + ne.

Particle decay

Charged pinions have a half-life of **τ ~ 2.6 × 10−8**

.the resulting muons are also transient particles, with a half-life of τ ~ **2.2 × 10−6s**, and then decay- The half-life values represent the decay time in the reference frame of the particle; the rate of decay of a particle in the system

laboratory reference is given by:

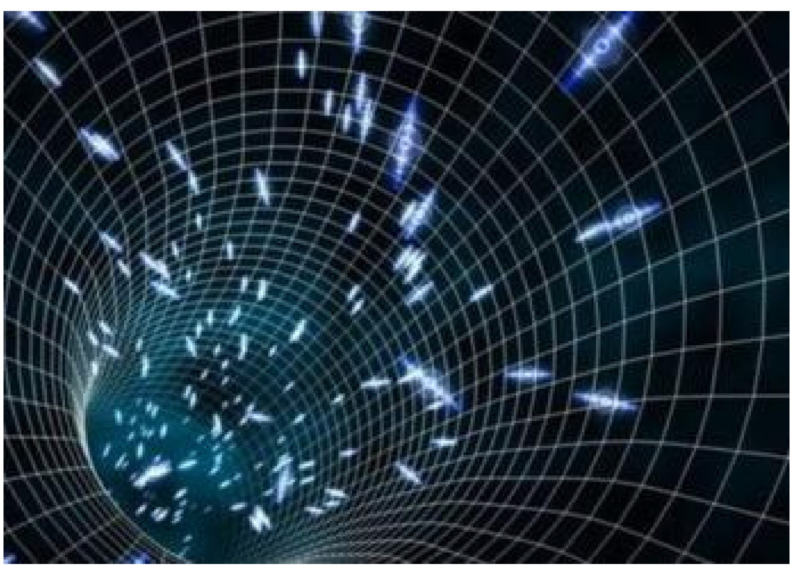
t−1
dec = **tE** mc2 −1

Radiation escape

The escape of radiation from a spherical region can be characterized with an escape rate tesc,

press(Eγ) = Rc/c
[1 + τKNf(Eγ)]

This type of radiation escape in singular magnetic fields of stars and black holes could give rise to new investigations of quantum particles that operate at a multidimensional level and behave like superluminal particles because they are attached to the shapes and curvatures or sections of the celestial bodies:



The development of radiation escape in magnetic fields within a possible quantum gravitational lensing effect:

Particle radiation escape algorithm to explain a possible structural effect of gravitational lensing at the quantum level:

f(Eγ) = 1 for x 6 0,1,1−Eγ/mec
2
0,9

for 0,1 < x < 1,
0 for x > 1,

(4.25)
τKN = 2Rc < σKNEe± > Ne±

(This escape happens simultaneously 20,000 times)
f(Eγ) = 1 for x 6 0,1,1−Eγ/mec
2
0,9

for 0,1 < x < 1,
0 for x > 1,

(4.25)
τKN = 2Rc < σKNEe± > Ne±

Pion injection
To estimate the injection of charged pions resulting from inelastic collisions pp. For a proton of energy Ep, the number of particles (pions) with energy in the interval (x, x + dx), where x = Eπ/Ep, that are created by pp collision can be parameterized.

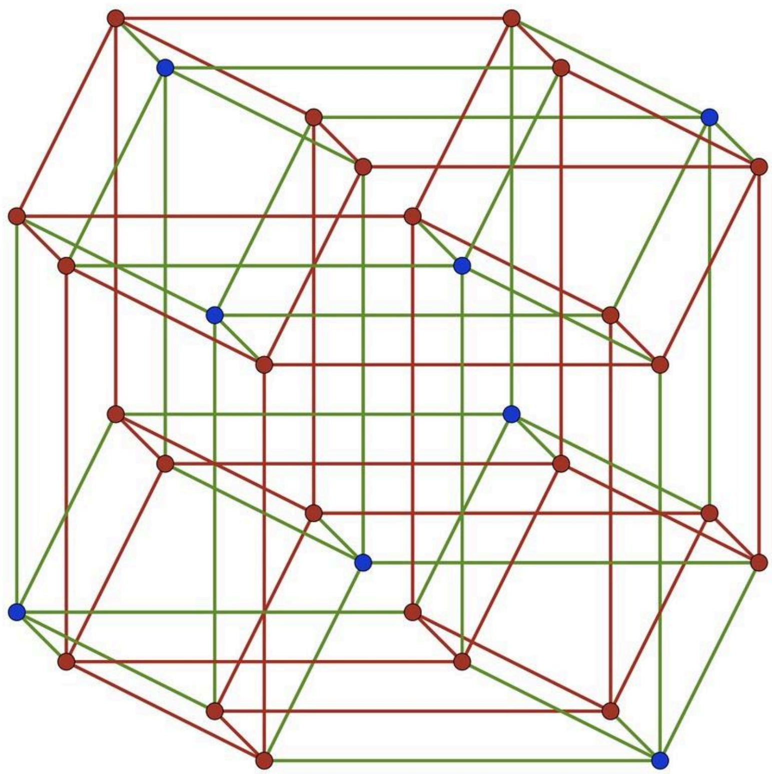
Photon energy integration variables:
The integration variables refer to the energy of the photons. Based on data obtained through simulations made with the SOPHIA code, Atoyan & Dermer [2003] introduced an approximation for the effective section:

plz
0) ≈ 340 µbarn 200 MeV 6

Engineering, collections

0 6 500 MeV 120 μbarn 0 > 500 MeV,

The estimation of the spectral energy distributions, or Spectral energy distributions (SEDs), of galactic black hole coronas, as well as other magnetized plasmas, is a very complex task, since it must include, among other things, a detailed knowledge of the characteristics of the plasma and the microphysics of the system.



1. Quantum optics and the states of light:

Summary: I would like to make a comparison between quantum cryptography and quantum optics to be able to investigate in a structural and computational way the possible origin of superluminal structures within the set of high-dimensional combinatorics in the field of black hole structures and radiation of celestial bodies.

3.1 Photons

The Hamitonian is Hˆ = ℏω(ˆa†ˆa + 1/2). Based on Planck's hypothesis we believe that a photon has energy ℏω, so we interpret the ˆn = ˆa†ˆa as the number of photons in the mode. This means that ˆa(0) destroys a photon, and ˆa†(0) creates one.

3.2 Vacuum

The ground state of the field is the "vacuum state" |0i defined by h0| ˆa†ˆa |0i = 0. It has non-zero energy Evac = ℏω/2 and fluctuations (ΔX1,2)

2 =< Xˆ 2
1,2 > − < Xˆ

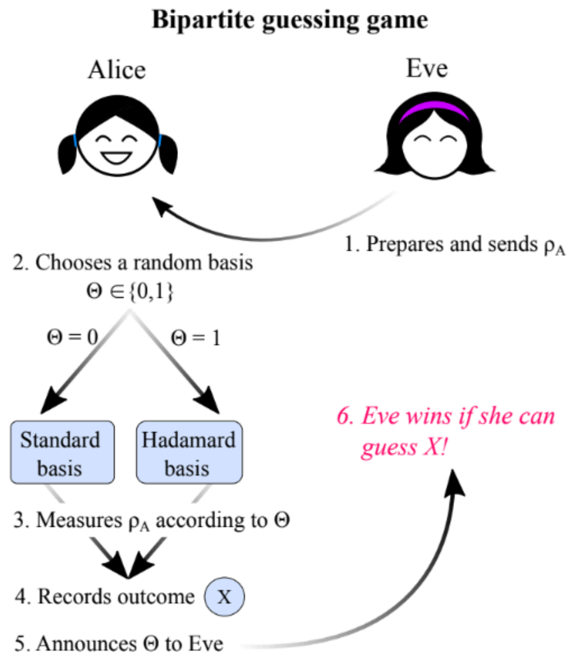
1,2 >2= 1. Thus it is a

minimum uncertainty state δX1δX2 = 1.

Variations of photoluminous states:

ˆn |ni = n |ni. These are energy eigenstates with energy ℏω(n + 1/2). The number states are complete and orthonormal, and for many problems, especially those involving photon counting,
They are the most natural basis to use. They are, however, very far from classical behavior.
For example, the expectation values of the quadratures are hn| Xˆ

1,2 |ni = 0, while the variances are (ΔX1,2)2



Quantum State Cryptography:

Given density matrices ρ1 and ρ2, the fidelity between **p1** and **p2** is
F(ρ1,ρ2) = trq√ρ1ρ2√ρ1

(3.14)
For pure states ρ1 = |Ψ1ihΨ1| and ρ2 = |Ψ2ihΨ2|
The fidelity takes on a simplified form:
F(ρ1,ρ2) = |hΨ1|Ψ2i| . (3.15)
If only one of the states ρ1 = |Ψ1ihΨ1| is pure, we have
F(ρ1,ρ2) = p

hΨ1|p2|Ψ1i .

Although the fidelity is not a metric (since F(ρ1,ρ2) = 0 does not imply that ρ1 = ρ2), it does have an intuitive interpretation, if we were to verify whether we managed to produce a desired target state |Ψi. Suppose that we want to build a machine that produces |ΨihΨ|, yet we are only able to produce some state ρ. Let us suppose we now measure ρ to check for success. We can do this (theoretically) by measuring
Msucc = |ΨihΨ| , (3.17)
Mfail = I−|ΨihΨ| .

Superluminal Particles and quantum states entropy:
For a binary random variable $X = \{0,1\}$, the comparison between Shannon entropy $H(X)$ and its min-entropy $H_{min}(X)$.

Show that the min-entropy satisfies the following bounds:

$$0 \leq H_{min}(X) \leq H(X) \leq \log|X|.$$

The conditional min-entropy
Can we also quantify the uncertainty about X given some extra quantum register E? It turns out that just like for the von Neumann entropy, the min-entropy has a conditional variant $H_{min}(X|E)$ developed in [Ren08]. The easiest way to think about the conditional min-entropy is in terms of the probability that Eve manages to guess X given access to her quantum register E. Note that we see from the cq-state that some random state ρ_E of f(x) with probability p_x and her goal is to guess x by making a measurement on E.

The energy eigenstates (number states) have zero average field. Clearly this isn't the case when We turn on a laser or a microwave oven. Is there a quantum state that behaves like an oscillating electric field? As in ordinary quantum mechanics, in order for an observable to oscillate, there has to be a superposition of at least two states with different energies. In the case of the electric field (or the quadratures) this means there has to be a superposition of different numbers of photons. What about a state like;

$$|\psi\rangle = \frac{1}{\sqrt{2}}(|0\rangle + |1\rangle)$$

Conditional min-entropy. Consider a bipartite cq-state ρ_{XE} where X is classical. The conditional min-entropy $H_{min}(X|E)$ can be written as $H_{min}(X|E)_{\rho_{XE}} := -\log O\ \mathrm{guess}(X|E)$

Example of multiple particle states:

$$
\begin{aligned}
P_{\text{guess}}(X|E) &= \max_{\substack{M_1, M_2 \geq 0 \\ M_1 + M_2 = \mathbb{I}}} \left[\frac{1}{2} \operatorname{tr}(M_0 |0\rangle\langle 0|_E) + \frac{1}{2} \operatorname{tr}(M_1 |+\rangle\langle +|_E) \right] \\
&= \max_{0 \leq M \leq \mathbb{I}} \left[\frac{1}{2} \operatorname{tr}(M |0\rangle\langle 0|_E) + \frac{1}{2} \operatorname{tr}(|+\rangle\langle +|_E) - \frac{1}{2} \operatorname{tr}(M |+\rangle\langle +|_E) \right] \\
&= \frac{1}{2} + \frac{1}{2} \max_{0 \leq M \leq \mathbb{I}} \operatorname{tr}[M(|0\rangle\langle 0|_E - |+\rangle\langle +|_E)] \\
&= \frac{1}{2} + \frac{1}{2} D(|0\rangle\langle 0|_E, |+\rangle\langle +|_E).
\end{aligned}
$$

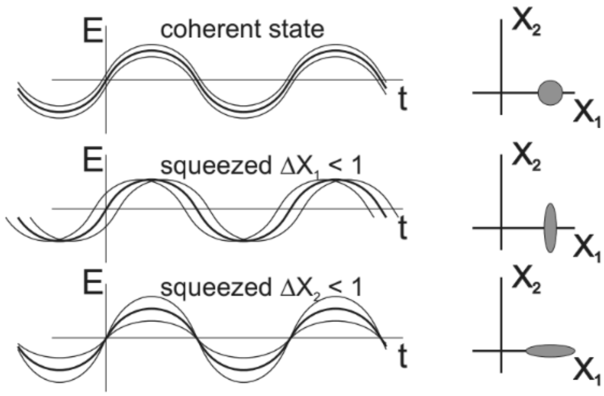
```
Consider the state ρXE =
1
2
|0ih0|X ⊗ |0ih0|E +
1
2
|1ih1|X ⊗ |+ih+|E.

Then the conditional min-entropy Hmin(X|E) = −logO guess(X|E) where the
variables are important to recalculate and optimize the crypto quantum
algorithm
```

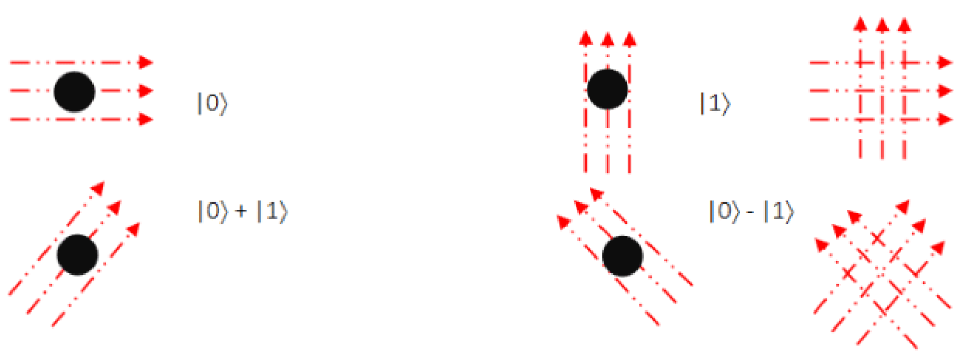
Note that the assumption that X is classical here is important: in particular, Hmin(X|E) can be negative if X is a genuine quantum register. Furthermore, we have
Hmin(X|E) ≥ Hmin(X)−log|E| . A general quantum conditional min-entropy
In the fully general case, the system X as we have seen above is not necessarily classical, but can also be quantum (to make explicitly this difference, we use A to label such a quantum system).

Frequency-quantum states: The average value and uncertainty for a coherent state (top) and two squeezed states with the same average values for the field. In each plot, the heavy line indicates the average field value < E(t) > while the light lines indicate the average plus/minus ΔE(t). **Right plots:** uncertainty ellipse representations of these states.

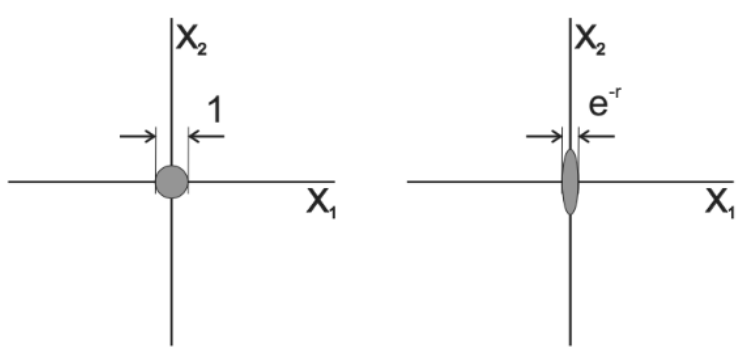
Engineering, collections



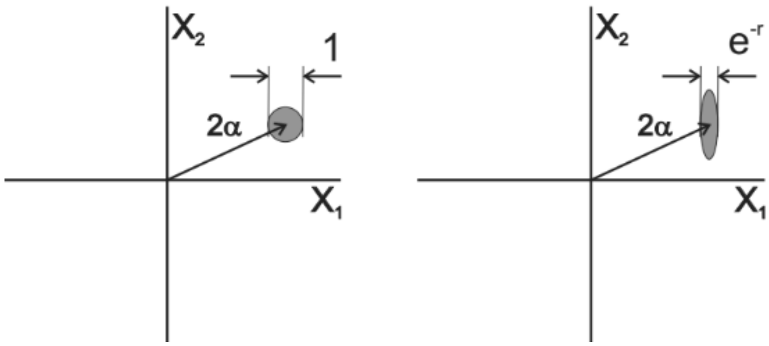
The type of quantum particles forming part of 17D-dimensional spaces could bend and transpose to different places in a galaxy and reproduce new high-dimensional algorithms that could be found in different types of quantum gravities not yet studied mathematically:



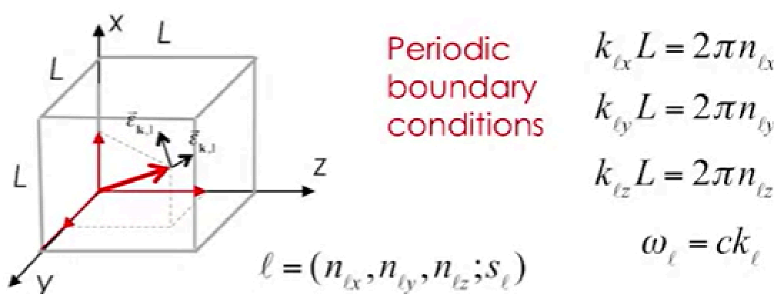
Uncertainty ellipse for a vacuum state (left) and squeezed vacuum with ΔX1 < 1 (right).



Uncertainty areas of a coherent state (left) and a bright squeezed state with ΔX1 < 1 (right).



Quantum polarization



Own States:

$$\hat{H}_\ell |n_\ell\rangle = E_{n\ell} |n_\ell\rangle \quad E_{n\ell} = \hbar\omega_\ell \left(n_\ell + \frac{1}{2}\right) \quad n_\ell = 0,1,2...$$

Eigenstates : $|n_1\rangle \otimes ... \otimes |n_\ell\rangle \otimes ... = |n_1, ..., n_\ell, ...\rangle$

with $n_\ell = 0,1,...$

Quantum cryptography;

Interferences (analysis)

Let us examine the statement that "the protocol cannot be adapted in the case of photons in the state

|F−⟩

|Φ −⟩" and consider whether there are any specific scenarios in which this might be true.

The Eckert protocol is based on the correlation properties of Bell states. In the state:

|F+⟩

|F +⟩,

Measurements on the same basis are perfectly correlated. However, in the state;

|F−⟩

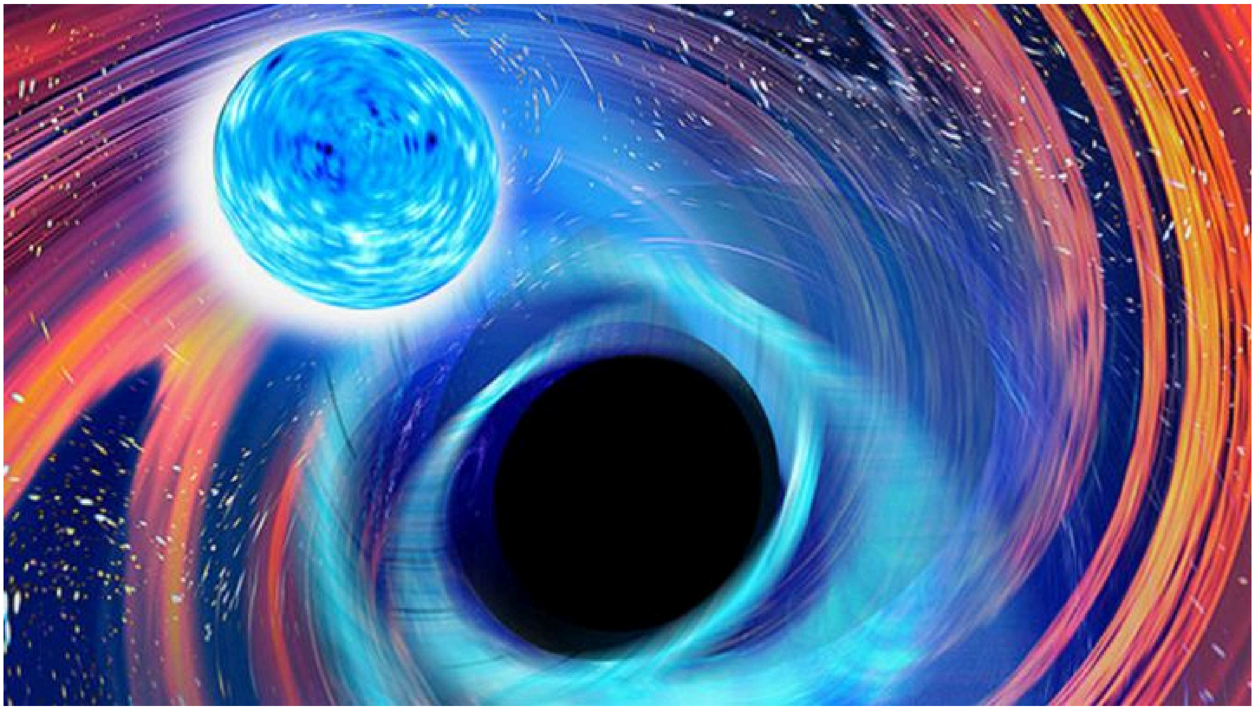
|Φ −⟩, the measurements on the same basis are perfectly anti-correlated.

To generate a secret key, Alice and Bob who are the bearers of the keys must be able to compare their measurements and agree on the values of the keys. If your measurements are anti-correlated, you can still generate a secret key by appropriate adjustment (e.g. Bob flipping his bits). However, there are additional considerations that could complicate protocol adaptation:

Interferences and Measurement Errors: In practice, imperfections in measurement devices and interference can introduce significant errors. If Alice and Bob's devices are not perfectly synchronized or if there is a lot of noise, the protocol could be less robust when using

|F−⟩

|Φ −⟩ due to the need for bit inversion, increasing the error rate.



It should be taken into account that these quantum effects and crypto qubits have an application in high-dimensional theory models:

1) For high dimensions in superluminal particles
2) For the correspondences between tensors or products of tensors in a curve of a possible quantum black hole whose gravitational morphology would be very different from the one already known.

Specific Conditions of the Quantum Channel: In some specific scenarios, quantum channel conditions can cause inverse quantum state correlations:

|F−⟩

|Φ −⟩ they may not be used efficiently. For example, if the quantum channel introduces phase errors that differentially affect correlated versus anti-correlated states, this could make it difficult to generate a secure key.

Difficulties in Detecting Eavesdroppers:

The Ekert protocol uses the Bell test to detect the presence of a spy **(eavesdropper).** If the status is as follows:

|F−⟩

|Φ −⟩ and the measurements are **anti-correlated**, the detection of statistically significant deviations can be more complicated or less efficient, affecting the security of the protocol.

Given these points, the specific scenario in which the protocol could not adapt is one in which channel and device imperfections, as well as the need for additional processing **(bit inversion),** they cause error rates to be too high or protocol security to be compromised.

Therefore, under real conditions where noise and interference are significant and bit flipping adds additional complexity, the statement that "the protocol cannot adapt in the case of photons in the state

|F−⟩

|Φ −⟩" could be true. However, theoretically, the protocol can be adapted with the appropriate adjustments.

To identify which Bell state could be used for quantum key distribution using the same cryptographic protocol for both cases, but reversing the Bob bits, we must understand how the correlations in these states behave when measured on the same basis and how these Correlations can be corrected by bit inversion.

Engineering, collections

We then proceed to review the Bell states and their correlations when measured on the same basis (calculation of quantum Bell states).

$|F+\rangle=12(|00\rangle+|11\rangle)$

$|F\ +\rangle=\ 21(|00\rangle+|11\rangle)$

The measures are correlated: they both score 0 or they both score 1.

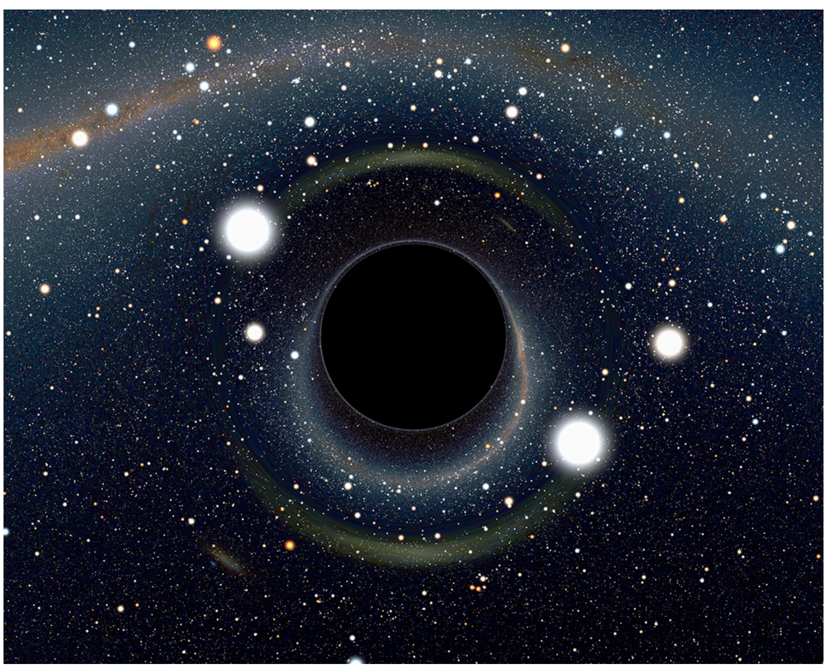
$|F-\rangle=12(|00\rangle-|11\rangle)$

$|\Phi\ -\rangle=\ 21(|00\rangle-|11\rangle)$

The measures are anti-correlated: if Alice gets 0, Bob gets 1, and vice versa.

$|\Psi+\rangle=12(|01\rangle+|10\rangle)$

$|Ps\ +\rangle=\ 21(|01\rangle+|10\rangle)$



The measures are anti-correlated: if Alice gets 0, Bob gets 1, and vice versa.

$|Ps\rangle=12(|01\rangle-|10\rangle)$

$|\Psi\ -\rangle=\ 21(|01\rangle-|10\rangle)$

The measures are correlated on different bases. Since the protocol in the video uses the state

|F+⟩|F +⟩, which has direct correlations (they both get the same result), if we want to use a different Bell state but need to flip Bob's bits to get the correct key, we look for a state that has direct anti-correlations.

Correct Status Identification

|F+⟩

|F +⟩: Already used in the standard protocol, direct correlations.

|F−⟩|Φ −⟩: Anti-correlated when $\alpha=\beta$

$\alpha=\beta$. If we invert Bob's bits, we get direct correlations, making it behave like |F+⟩|F + ⟩.|Ψ+⟩|Ps +⟩: Anti-correlated on the same basis, but correlations on different bases.

|Ψ−⟩

|Ψ − ⟩: Correlations in different bases, anti-correlated with a negative sign.

The structural analysis of qubits is:

|F−⟩

|Φ −⟩ why:

Alice and Bob's measurements are inversely correlated on the same basis.

If we invert Bob's bits, then the measurements will be correlated as in

|F+⟩|F +⟩.

Bit Investment

To use the same protocol as with

|F+⟩|F +⟩ but inverting Bob's bits, we need correlations after the inversion. Specifically, we need a state that originally has anti-correlations to become correlated upon reversal.

|Ψ+⟩

|Ps +⟩ **has direct anti-correlations:**

If Alice is 0, Bob is 1.

If Alice is 1, Bob is 0.

By reversing Bob's bits, if Bob measures 0, Alice measures 1 and vice versa, they become useful correlations. Therefore, the status could be as follows:

|Ψ+⟩|Ps +⟩ by reversing Bob's bits it becomes correlated, just like the state |F+⟩|F+⟩.

Effect of Device V(quantum)

The V device plays a crucial role in optimizing quantum teleportation. Here are the options and their revised analysis:

Quantum analysis options:

- Quantum device V stays nearby (quantum teleportation)
- This option does not provide any specific operation that can optimize quantum teleportation by detecting
- $|\Psi+\rangle$
- |Ps +⟩. It does not describe how the photon's quantum state should be modified to maintain teleportation coherence.

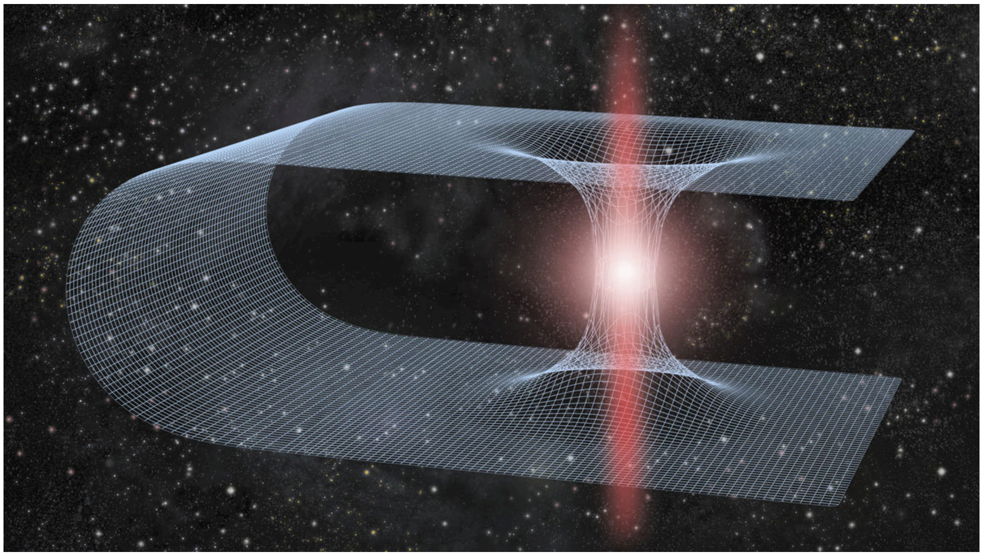
V acts as a half wave plate with proper axes at a 45° angle to the states of special teleporting particles.

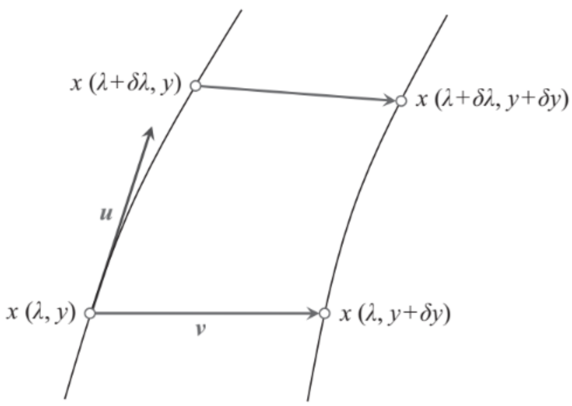
$|x2\rangle$|x 2 ⟩ and $|y2\rangle$|and 2⟩.

A half wave plate in this context does not preserve the original quantum state. Furthermore, an angle of 45° does not correspond to the operation necessary to maintain the original polarization information of the photon.

Conclusion: For bases of quantum frequencies, it is necessary to understand the contexts of quantum optics and its applications or quantum cryptography and what relationships these quantum aspects have with the theoretical appearance of mirrors at the level of elastic transition effects that curve different types of gravity and that are modified. by this type of special superluminal particles that consist of orbital dimensions of 20D.

Scenery: Inversions of dimensions and multiplicity of quantum states in a black hole composed of different mutually compatible quantum gravities.





Tensors in quantum black holes

Causal sets

The chronological future I+(Q) (chronological past I−(Q)) of a set Q is the set of points for each of which there is a past-directed (future-directed) time-like curve that intersects Q.
The curve $x\mu(\lambda)$ is said to be causal (or non-space-like) if its tangent vector $u\mu = dx\mu/d\lambda$ obeys the condition $u\mu\ u\mu \leq 0$ at each of its points. A non-space-like (causal) curve between two points, which is not a null geodesic, can be deformed into a time-like curve connecting these points.
The causal future J+(Q) (causal past J−(Q)) of a set Q is the set of points for each of which there is a past-directed (future-directed) causal curve that intersects Q. The future Cauchy domain D+(Q) (past Cauchy domain D−(Q)) of a set Q is the set of points such that any past-directed (future-directed) causal curve passing through it intersects Q (see Figure 3.6).

A surface is called space-like, time-like, or null, if its normal vector is time-like, space-like, or null, respectively. A global Cauchy surface in a spacetime M is a non-time-like hypersurface that is intersected by each causal curve exactly once.

Image of a possible quantum hole where the tensors or curves of space are modified by superluminal particles that generate high dimensions of quantum gravity;

Properties of the covariant derivative

The covariant derivative possesses the following properties:

1. Linearity: For constants a and b one has $\nabla\mu$(aA...
... + bB...
...) = a$\nabla\mu$A...
... + b$\nabla\mu$B...
....

2. Leibnitz rule: $\nabla\mu$(A...
...B...
...) = $\nabla\mu$(A...
...)B...
... + A...
... $\nabla\mu$(B...
...).

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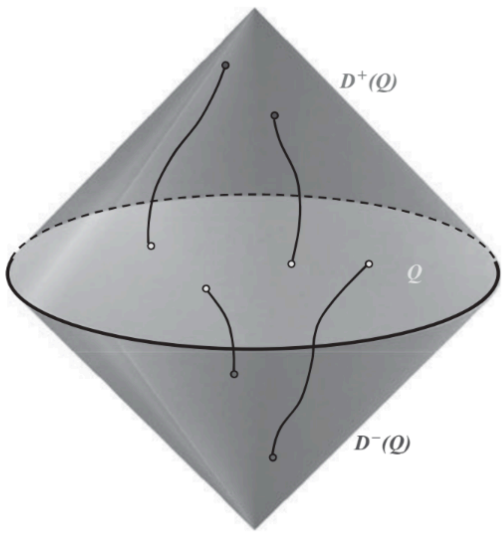
Lie transport
One can generalize the above definition of the Lie derivative to the case of an arbitrary tensor field. Let M be a differentiable manifold, and let f λ be a one-parameter group of diffeomorphisms of M onto M. Denote pλ = f λ(p).



High dimensions and particles with properties similar to qubits in quantum black holes:

High dimensional properties:

3) High dimensions are presented in superluminal particles of order 16D
4) For the correspondences between tensors or products of tensors in a curve of a possible quantum black hole whose gravitational morphology would be very different from the one already known. Special morphology “analogous to a mirror of water” in which quantum states are reflected and modified in various water outlets:
5) Huge data structure

Specific Conditions of the Quantum Channel: In some specific scenarios, quantum channel conditions can cause inverse quantum state correlations:

|F−⟩

|Φ −⟩ they may not be used efficiently. For example, if the quantum channel introduces phase errors that affect correlated versus anti-correlated states differently.

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The Lie derivative obeys the following relations
1. Lξ ξ = 0;
2. Lξ (αA...
... + βB...
...) = αLξ A...
... + βLξ B...
... **(α and β are arbitrary constants)**;

3. Lξ (A...
... B...
...) =

Lξ A⋯
⋯
B⋯
... + A...
... Lξ B...
...;
4. Lξ Lη − Lη Lξ = L[ξ ,η]

.

Properties and structures of high dimensions and superluminal particles:

Giant data structures offer us a robust approach to bridging the gap of where qubits and special quantum particles will be found computationally:

Structure and positions in matrix arrangements: [][][][▵][][][][][][][Δ][][][][][][][◦][][][][][][▵][[]][][][[]][][][][][][][≈[]

- The positions and how to structure high dimensions of a possible quantum particle or a qubit
- Structuring data to program in giant nodes of mathematical trees what functions each quantum model of each quantum particle performs
- Public Iterable <Position> <E>> children (Position <E>V)

- **Interface [][][][][][][][]**
- **Int**
- **Boolean**

Engineering, collections

- **Iterator**
- **Interpolate ▯▯▯**

Quantum mirrors

Scenery: Imagine that you are on the bank of a river with a stone in your hand, ready to throw it and make it bounce over the water. When throwing it, we observe how the stone hits the surface, bounces and continues forward, creating waves in the water each time it hits. Now, visualize this process in the context of high dimensions and a quantum black hole.

Stone Bouncing in Water (Quantum Dimensions)

Stone Throwing

Think about the moment you throw the stone. That launch is like a major event in the quantum world, like when a small particle moves through space.

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Impact on Water (First Visible Dimension)

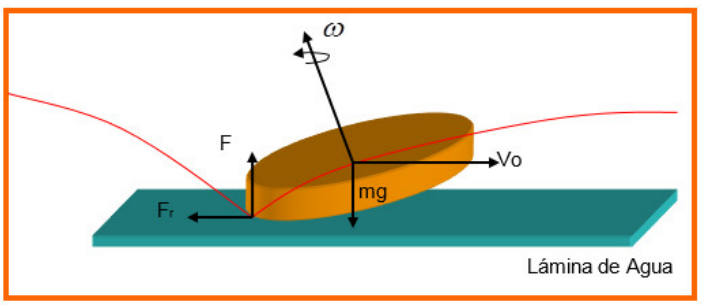
The first time the stone hits the water and bounces, it's like when that small particle interacts with something for the first time. This is something we can see, like the first touch of the stone with the water.

Bounces and Waves (Interactions in Higher Dimensions)

Every time the stone bounces, it creates ripples in the water that spread. Each bounce is like a new interaction of the particle in other dimensions. Ripples in water are like the disturbances that these interactions create in space.

The Water Mirror: Combinatorics of hidden high dimensions

Now imagine that the water is not just a flat surface, but like a mirror that reflects every bounce of the stone. This mirror represents dimensions that we cannot easily see. Quantum interactions not only occur in one dimension, but in many at the same time.



Reflections and Modifications

Every time the stone touches these water mirrors, it changes a little and also changes the mirrors. In the quantum world, each interaction changes both the particle and the environment around it. These additional dimensions reflect and amplify these changes.

Human Perception

Limited Viewing

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From the shore, you can see the stone bounce on the surface of the water, but you cannot see how the reflections multiply and change in the water mirror. We, as humans, can only see some things in the quantum world, but many others remain hidden.

Complex Quantum Interactions

The water you see is just a small part of a much larger system. The quantum environment is much more complex than we can see directly. Scientists use special mathematics to describe how these interactions unfold in many dimensions.

Qubits: The number of positions is multiplied [][][][][][][][][][][][][]
The structures of the qubits are transposed at different far distances without generating any movement. Since what happens is that high dimensions or high-dimensional combinatorics make it easier for qubits or special particles to be present, for example near a possible exoplanet, in the vicinity or close tensor curves at a spatial level and that at the same time they are in a quantum hole at billions of megaparsecs

Conclusion

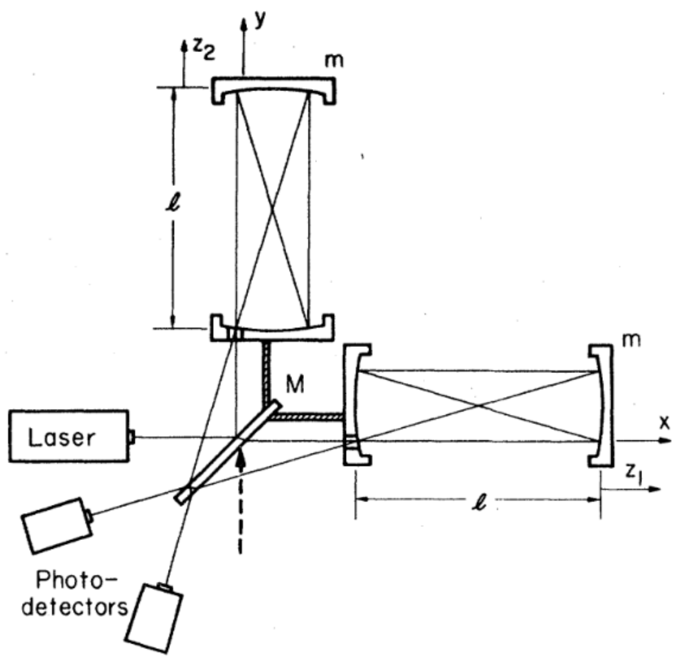
This analogy of a stone bouncing in the river helps us imagine how quantum particles interact in a high-dimensional environment. The visible waves and bounces are only a small part of a much more complex system. Although we can only see the surface, the true nature of these phenomena is in the additional dimensions that we cannot see directly.

Properties of quantum gravity:

1. A possible one-qubit structure (Extra dimensions and special type modifications of quantum gravity would take place in tensors or products of tensors of a possible spatial quantum hole)
2. What is also interesting about the structures of a type of particle represented within the structural framework of the search for new types of quantum gravity in other galaxies.

Photodetectors and software projects with quantum algorithms and data structures;

From the superposition of the coherent excitation of mode 1 on fluctuations in mode 1';
these input power fluctuations perturb only the sum of the end masses' momenta and, therefore, do not affect the interferometer's performance. Equation (2.19b) also displays the effect of putting mode 2 in a squeezed state. In the arms of the interferometer one quadrature phase of mode 2 is in phase with the coherent excitation of mode 1'—but with opposite sign in the two arms.



2.19b

a^k,ε|ni =√n|n − 1i (2) **a^†k,ε|ni =√n + 1|n + 1i (3)**

2. Photon number statistics. Give the probability P(n) to have n photons. This is a Poisson statistics. Give its average value and variance.
3. How many photons is there in the cavity of a P = 1 mW HeNe laser with a cavity length of L = 10 cm (wavelength λ = 638 nm, cavity finesse f = 100). Assuming that a laser field is in a quasi-classical state within a very good approximation, what is the magnitude of photon number fluctuations in the cavity.

4. Time evolution. We consider the initial state |ψ(0)i = |α0i. Show that |ψ(t)i is a quasi-classical state and give the expression of α(t).

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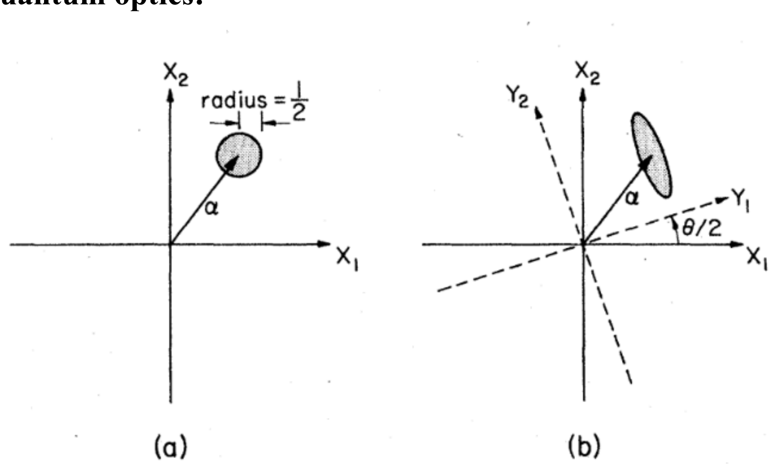
Along this problem we established various properties of a quasi-classical state, which are outlined below
(a) Quasi-classical states are equivalently called coherent states or Glauber states.
(b) Quasi-classical states are defined down to α = 0. The vacuum is thus a quasi-classical state.
(c) The relations aˆ|αi = α|αi and hα|aˆ
† = α*hα| are very important. They allow to compute
average values of any radiation field operator provided it is expressed as a function of aˆ
and aˆ†in normal order, i.e. with all aˆ† at the left and all aˆ at the right in products of operators. The simple rule for calculating average values is then : replace all aˆ
† with α*and all aˆ with α.
(d) For a quasi-classical state the electric field amplitude variance is ∆E2 = E (1)
k2
. In a quasi-classical state, fluctuations of the field amplitude are the same as for vacuum. These fluctuations are translated in the complex plane at the top of the average field amplitude
α. quasi-classical states are thus superposition states with minimal quantum fluctuations.
In the limit of large photon numbers, relative field amplitude fluctuations vanish as 1/α.
(e) The total energy for a quasi-classical field is the sum of the classical energy of a classical field with complex amplitude α and of the energy corresponding to vacuum fluctuations.
As compared to any other superposition state (see as an example the state defined by
equ. 4) a quasi-classical state have the maximal complex amplitude one can build out of a superposition state with a given average energy. This amplitude is reached together with minimum quantum fluctuations.

Quantum optics:



Software/Hardware Project Structure

1. **We will need several classes to model the interferometer components and quantum noise:**
1. Laser: Represents the light source.
2. Interferometer: Represents the interferometer.
3. **Quantum Noise:** Handle quantum noise.
4. BeamSplitter: Represents a beam splitter, an essential component in interferometers.
5. Detector: Represents light detectors.

{a) **Error circle in complex-amplitude plane**

for coherent state i n). (h) Error ellipse in complex-amplitude plane for squeezed state)n, re'e) (r&0).

3. Class Implementation

```
package com.optica.quantica;

public class Laser {
    private double wavelength;

    public Laser(double wavelength) {
        this.wavelength = wavelength;
    }

    public double getWavelength() {
        return wavelength;
    }
}
```

For simplicity I assume ~»rn, so that the radiation-pressure-induced motion of the beam splitter can be ignored and the beam splitter can be regarded as at rest. Each arm of the interferometer has a fiducial length l, and the dis- placements of the end mirrors from their fiducial positions are denoted z, and z, .

hEˆ2k,ε
(z)i − hEˆk,ε(z)i2
.Does this variance depend on z ?

```
package com.optica.quantica;

import java.util.Random;

public class QuantumNoise {
    private Random random;

    public QuantumNoise() {
        this.random = new Random();
    }

    public double addNoise(double signal) {
        return signal + (random.nextGaussian() * 0.1); // Adding Gaussian
noise
    }
}
```

To integrate software developed in Java with quantum circuits made with Qiskit on IBM Quantum. Qiskit is a Python library for working with quantum computers, while its software is written in Java. Here is a general approach to get started:

Instalar Qiskit:

```
bash
pip install qiskit
```

IBM Quantum Account Configuration: You will need an IBM Quantum account. Once you have one, you can set up your account in your Python environment:
python:

```
from qiskit import IBMQ

IBMQ.save_account('YOUR_API_TOKEN')

IBMQ.load_account()
```

2. Creation of the Quantum Circuit with Qiskit

Next, create a quantum circuit that represents the quantum pulse. Here is a basic example:

```
from qiskit import QuantumCircuit, transpile, Aer, execute

# Create a simple quantum circuit
qc = QuantumCircuit(1) # 1 qubit
qc.h(0) # Apply a Hadamard gate
```

3. Integration with Java

To integrate Java software with the quantum circuit made with Qiskit, you can use an external process calling approach or communication through sockets or REST APIs.

Approach 1: Call to External Processes

Use the command `ProcessBuilder` Java to call a Python script that runs the quantum circuit.

Python script (quantum_circuit.py):

```
import sys
from qiskit import QuantumCircuit, transpile, Aer, execute

# Create and run the quantum circuit
qc = QuantumCircuit(1)  # 1 qubit
qc.h(0) # Apply a Hadamard gate

simulator = Aer.get_backend('qasm_simulator')
compiled_circuit = transpile(qc, simulator)
job = execute(compiled_circuit, simulator)
result = job.result()
counts = result.get_counts(qc)

print(counts)
```

Create Interferometry Algorithms with Qiskit

First, you have to define the interferometry algorithms using Qiskit. Here is a basic example of an algorithm that uses a quantum circuit to simulate interferometry:

```
# interferometer.py
from qiskit import QuantumCircuit, Aer, transpile, execute

def interferometer_circuit():
```

```
    qc = QuantumCircuit(2, 2)
    qc.h(0)  # Hadamard gate on qubit 0
    qc.cx(0, 1)  # CNOT gate
    qc.h(0)  # Another Hadamard gate
    qc.measure([0, 1], [0, 1])  # Measure both qubits
    return qc

def run_interferometer():
    qc = interferometer_circuit()
    simulator = Aer.get_backend('qasm_simulator')
    compiled_circuit = transpile(qc, simulator)
    job = execute(compiled_circuit, simulator)
    result = job.result()
    counts = result.get_counts(qc)
    return counts

if __name__ == "__main__":
    print(run_interferometer())
```

Fluctuations and errors in a possible quantum circuit:

The hamiltonian describing the interaction of the quantized radiation field to a classical current source j(t) = j sin ωt located at z = 0 is

Hˆint(t) = −j(t).Aˆ (0)

(b~ b, b, b,)2
(b~ b, b, b,)1
(b~ b, b, b,)2
(b~ b, b, b,)1

The radiation field state at time t has the form |ψ(t)i = Dˆ(α(t))|0i, where

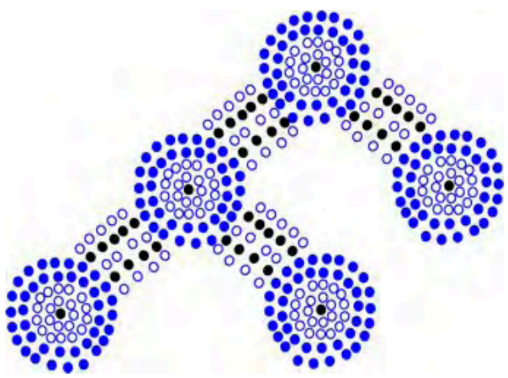
Dˆα(t)= eαaˆ†−α*aˆ
. Give the expression of the complex number α(t) (one can use the **relation Uˆ +0(t) = Uˆ0(−t)).**

Data structures with algorithms for quantum hardware (Java, Qiskit, Docker swarm)

The importance and the truly pure way in which algorithms are executed and described is crucial to be able to realize new technology hardware and software. The strongest part of the hardware and software is being able to fit the algorithms and mechanics of automation with the bases of the algorithms of quantum cryptography. To do this, in this section I will address three important points before continuing with the possible effects of quantum tensors or tensors on quantum black holes.

The software To build the algorithms it is based on data structures, Java, IBM Quantum, Docker and Kubernetes.

We need to establish solid foundations of structured algorithms and imagine how they work in a possible photodetector-type quantum processor or microcontroller. I would also like to understand how the interferometer, photodetector, Qiskit and Java interact in a hostile environment such as simulations and hostile aerospace environments.



Describe a nonrecursive algorithm for enumerating all permutations of the numbers {1,2,…,n}.

Methods implementation: an implementation of the methods addLast and add Before realized by using only methods in the set {isEmpty, checkPosition, first, last, prev, next, addAfter, addFirst}.

Implement quantum operators in a data structure:

```
public class ElectricOperator <E> implements Dequeue <E> {

        protected DLNode <E> polarization, wavevector
        Protected int size;

}

WHERE Ek,t(z) = i

Public NodeDequeue(){

        Eheader = new ElectricOperator<E>();
        Trailer = new ElectricOperator<E>();
```

```
       Trailer = new ElectricOperator<E>();


}

Eheader.getNext(Ktrailer);
Ktrailer.setPrev(Eheader);
```

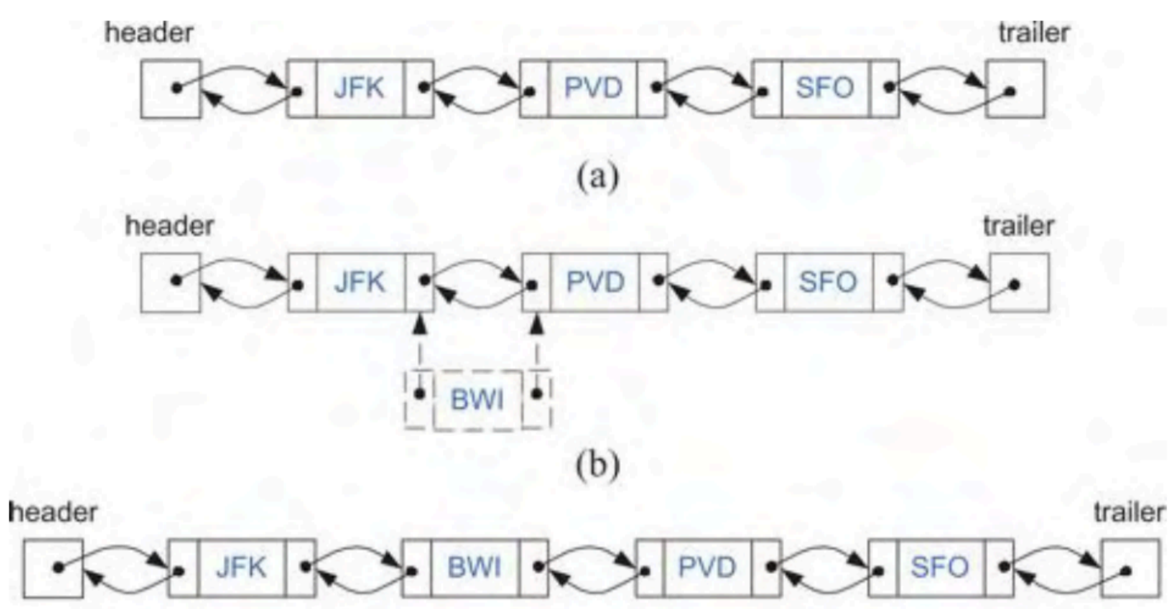
A,k,|n> $\sqrt{n}\,|(n - 1)$

```
public class ElectricOperator<E> implements Dequeue <E> {}
```

Describe the output of the following series of stack operations: push(5), push(3), pop(), push(2), push(8), pop(), pop(), push(9), push(1), pop(), push(7), push(6), pop(), pop(), push(4), pop(), pop().

```
"((5 + 2) * (8 − 3))/4" is "5 2 + 8 3 − * 4 /".
```

Describe the output for the following sequence of deque ADT operations: addFirst(3), addLast(8), addLast(9), addFirst(5), removeFirst(), remove-Last(), first(), addLast(7), removeFirst(), last(), removeLast().



Engineering, collections

Suppose we have an n × n two-dimensional array A that we want to use to store integers, but we don't want to spend the O(n 2) work to initialize it to all 0's (the way Java does), because we know in advance that we are only going to use up to n of these cells in our algorithm, which itself runs in O(n) time (not counting the time to initialize A).

Notation: if "(exp1)op(exp2)" is a normal fully parenthesized expression whose operation is op. The method Alice can use is a static method, transfer(S,T), which transfers (by itera-tively applying the private pop and push methods) elements from stack S to stack T until either S becomes empty or T becomes full. So, for example, starting from our initial configuration and performing transfer(A, C)

Implement the stack ADT using the Java ArrayList class (without using the built-in Java Stack class).

Other data structures to implement in a Quiskit circuit:

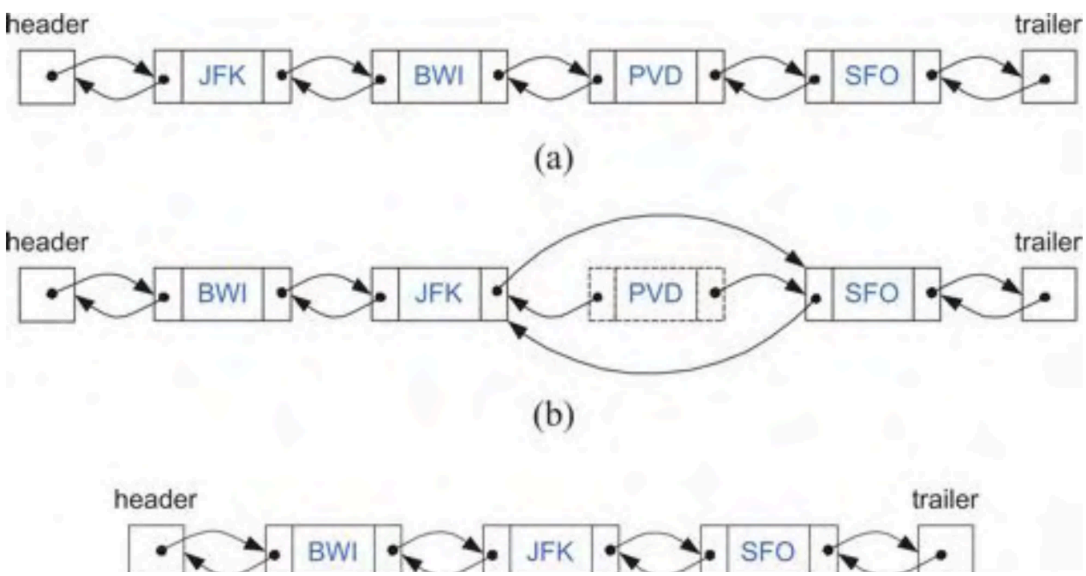
```
Map<multiKey, BigDecimal> mapMasterData
LIST<FactDatosMaestrosSIDTO> listDatosMaestros
LISTA<> listaQubits

//Retrieve master data from a database in quantum optics and
software:

MasterDataList <- executeSQLQuery("
SELECT service_qubit_id, concept_id, value FROM fact_master_data;
WHERE quibit_circuit_algorithm = 'Q'
AND id_qubit_servicio IN (1,2,3,4)")
```

```
//Map master data to a Multikey Map
FOR each dataMaster IN listDataMasters DO
Multikey<Integer> key <- new MultiKey(masterdata_service_id,
masterdata_circuit_id, masterdata_qubit_id_key_value)

mapaDatosMaestros.put(key, masterdata.value)
END FOR

//Recover current data and positions of qubits in an optical circuit
or virtual interferometer made of materials found in a black hole or
quantum materials

circuitList <- executeSQLQuery("")
quantum_state_list <- executeSQLQuery("")
```

These algorithms are rich enough to be able to transform them into a qubit circuit or a possible quantum database.

It is possible that in order to generate and create new quantum circuits we need materials that we find in galaxies, stars and a series of compartments with software materials.

An algorithm to generate possible databases for quantum circuits that implement a laser with Python or Java;




```
public QuantumInterface Tree<E> {
  /** Returns the number of nodes in the tree. */
 public int size();
 /** Returns whether the tree is empty.*/
 public boolean isEmpty();
 /** Returns an iterator of the elements stored in the WaveTree for
quantum optics*/
 public Iterator<E> iterator();
/** Returns an iterable collection of the nodes. */
public Iterable<Position<E>> positions();
/** Replaces the element stored at a given node. */
public E replace(Position<E> v, E e)
 throws InvalidPositionException;
/** Returns the root of the WaveTree for Quantum algoritm */
public Postion<E> root() throws EmptyTreeException;
```

(2) Quantum lasers with algorithms and precision in calculations of variables and registration of BBDD data;

Integration of a Quantum Computer in a Rocket: Description and Strategies

Integration and Operation in Space To integrate a quantum computer into a rocket and ensure its operation in space, it is necessary to design to face extreme conditions and challenges specific to the space environment. The critical conditions and proposed solutions are detailed below.

Environmental Conditions of Space

- **Cosmic Radiation**
  - Challenge: It can damage electronic components and qubits.
  - Solution: Shielding with materials such as aluminum or lead, and use of radiation-resistant components.
- **Extreme Temperature**
  - Challenge: Superconducting qubits require extremely low temperatures.
  - Solution: Implementation of cryogenic cooling systems and insulating materials to protect against the heat of the Sun and the cold of deep space.
- **Space Void**
  - Challenge: It can affect the structure and operation of the devices.
  - Solution: Ensure complete hardware tightness.

Release Conditions

- **Vibrations and Shock**
  - Challenge: Throws generate significant vibrations and G-forces.
  - Solution: Design mounting systems with shock absorbers and perform laboratory vibration tests.
- **Depressurization**
  - Challenge: Rapid pressure transition can affect components.
  - Solution: Ensure hermetic design that withstands pressure changes.

Integration into the Rocket

- **Module Design**
  - Challenge: Integrate quantum hardware into the available rocket space.
  - Solution: Compact and modular design, with balanced weight distribution.
- **Electrical Power**
  - Challenge: Supply constant and reliable energy.

    - Solution: Use of solar panels and high-capacity batteries, with redundant systems.

Operation in Orbit

- **Communication**
    - Challenge: Establish and maintain reliable communication with Earth.
    - Solution: Use high gain antennas and communication protocols **quantum for security.**
- **Monitoring and Control**
    - Challenge: Monitor and control the system remotely.
    - Solution: Implement telemetry systems and remote control capabilities.

Redundancy and Fault Tolerance

- **Systems Redundancy**
    - Challenge: Ensure continuous operation in the event of failures.
    - Solution: Implement multiple quantum modules and backup systems for critical components.
- **Self recovery**
    - Challenge: Allow automatic crash recovery.
    - Solution: Develop advanced diagnostic and recovery software.

Validation and Testing

- **Environmental Testing**
    - Challenge: Validate operation in space conditions.
    - Solution: Use vacuum and temperature chambers, and perform radiation tests.
- **Integration Testing**
    - Challenge: Ensure the joint functioning of all systems.
    - Solution: Perform comprehensive testing and full mission simulations.

Technical documentation

- **Schemes and Diagrams**

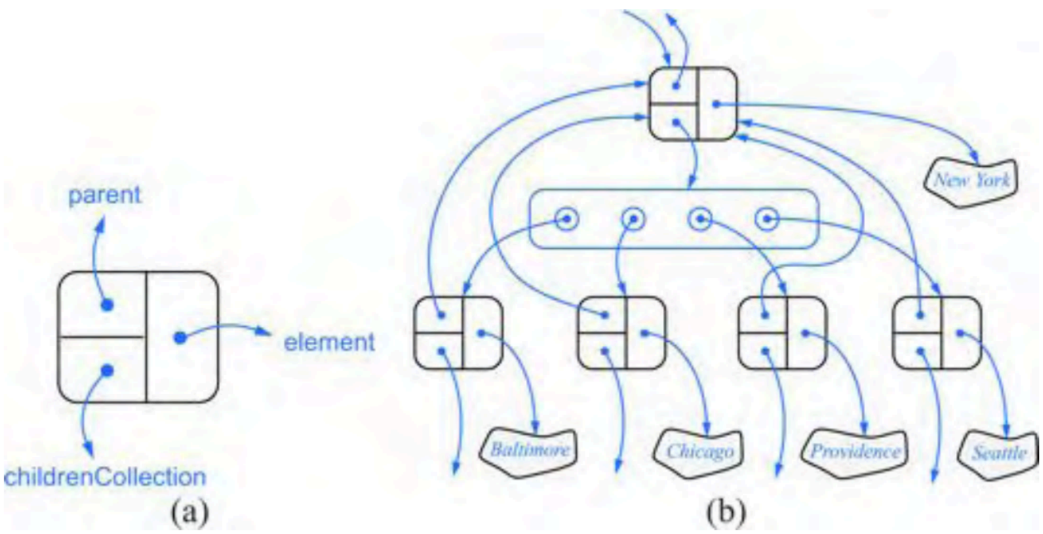
Engineering, collections

    - System block diagram.
    - Cryogenic cooling system diagram.
    - Energy distribution and assurance scheme.
- **Manuals and Procedures**
    - Operation manual from Earth.
    - Emergency protocols for unexpected failures or problems.

Additional Resources

- NASA regulations on electronic systems in space.
- Publications on quantum computing and quantum entanglement.

Element structures;



Ideas for future research:

- **Exoplanets and models of intelligent life**
- **Quantum environments**
- **Quantum circuits**