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AN ANALYSIS OF AN ANALOGY OF HOW THE THEORY OF RELATIVITY WOULD BE TRUE.OR FALSEBY ALBERT EINSTEIN, AS A TEACHING METHOD FOR RAISING HYPOTHESES IN CONCEPTUAL PHYSICS

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SUMMARY

This article is intended to do the Analysis of an Analogy of How the Theory of Relativity Would Be Trueor Falseby Albert Einstein,as a didactic approach to hypothesis formulation in the Conceptual Physics of Einstein's Theory of General Relativityand the Theory of Viscosity in Fluid Mechanics in University Physics, such as Newton's Law ofFluids and Reynolds' LawofFluidsthroughconceptualepistemologyandmodelbuildingforknowledgeconstructionand the necessary analyses in the construction of a theoretical calculation model and computational simulation.a practical and didactic conceptual approachfor complexityof knowledge.

INTRODUCTION

The intention of this article is to analyze the assumption that the Theory of General Relativity could be proven true, given that...as oGravitational waves are ripples in the fabric of spacetime, predicted by Albert Einstein in 1916.The first direct detection occurred inSeptember 2015by the observatoryLIGO, proving the collision of two black holes 1.3 billion light-years away. Since then, more than 90 cosmic events have been recorded.[2].Knowing that in the Theory of General Relativity and in Astrophysics the calculations are advancedand computational, predominantly in simulations of the Theory of General Relativity and Astrophysics, such as the behavior of the cosmos, an example is the Portuguese physicist Vitor Cardoso. The Portuguese physicist Vitor Cardoso (professor at Instituto Superior Técnico and Instituto Niels Bohr) leads cutting-edge studies on Einstein's General Relativity. He uses supercomputers to simulate blackhole collisions.and gravitational waves, testing the limits of the theory under extreme conditions[3].And the astronomical observations likened to the instrument Luciferthe former name of an astronomical instrument (an infrared camera and spectrograph) installed inLarge BinocularTelescope(LBT), on Mount Graham,Arizona (USA). The instrument was renamed toLUCIin 2012 due to public controversies, which would be necessary for a real study of Astronomy and Astrophysics[4]. But highlighting that one can use verifiable empirical data in scientific journalsand analogies of prototype simulations that can become computational, as an example simulating a neutron star requires supercomputers equipped with tens or even hundreds of thousands of processors (CPU cores). The calculations are so complex that the merger of two neutron stars, lasting only 1.5 seconds in real life, can consume up to 130 million hours of processing[5].For example,mathematics uses **definitions**,**axioms**,**conjectures** and **theorems** as essential tools of its logical structure. This mechanism serves to build mathematical knowledge deductively; analyses in Physics and Astrophysics can proceed in this way.How to **Schrödinger equation** It is the mathematical basis that models and solves the structure of the electron cloud. In quantum mechanics,theelectron does not have a fixed trajectory; the equation calculates its...**wave function** (\(\psi \)), whose square (\(\psi ^{2}\)) reveals the region of **probability** to find it — what we know as an electron cloud or orbital cloud.

The example from cosmology discussed in this article will be that of two galaxies in the Theory ofGeneral Relativityin its encounter according to the theory of the Doppler effect and gravitational lensing with the deductive process of the expansion of the universe and the Big Bang Theory [1][6][7] and the Theory of Viscositywith the process ofNewton-Reynolds Equation[8][9] approached in a way that draws an analogy with epistemology, shaping a theoretical model of calculation and computational simulation, for example, a processor like in a common home computer of a student and an independent student of Mathematics and Physics, who may use more processors depending on the needs of the epistemological conceptual model created and raised in theresearch.Therefore,thequestionpresentedinthearticleisusefulforunderstandingtheconcepts and constructing conceptions of the reality of Physics for the absorption and construction of knowledge. Understandings such as the philosophy of Karl Popper and Thomas Kuhn in the construction of the philosophy of teaching can be addressed as support in the pre-analysis proposed in the article; both authors serve in such a way that the history of the construction of science and revolutionsScientific revolutions occurred, highlighting specific moments and characteristics of their historical context, especially within the socio-cultural context. The socio-cultural context is crucialforscientificrevolutions, suchas English mercantilismwith

IsaacNewton andAdamSmith, following the European Renaissance. The Napoleonic Wars and...the engineer Joseph Fourier, just as theSecondWorldWar and the development of Nuclear Physics by theAllies and theAxis, like a smartphone revolution in today's specific socio-cultural context, like many political issues disseminated throughout the world, constantly create scientific revolutions that are transformed according to what Karl Popper and Thomas Kuhn analyzed in their theories of philosophy of education.

ThomasKuhn'sTheoryin*TheStructureofScientificRevolutions*

Thomas Kuhn developed his theory of scientific change in the book The Structure of Scientific Revolutions. He argued that science does not progress through a simple, continuous accumulation of knowledge. Instead, scientific development occurs through periods of stability followed by revolutionary changes in scientific thinking.

TheConcept ofa Paradigm

The **paradigm** is a set of theories, methods, assumptions, and standards that guidesscientific research. It provides a framework for understanding the world and solving scientific problems.

Examplesofparadigmsinclude:

- NewtonianMechanicsinclassicalphysics.
- Heliocentrisminastronomy.

StagesofScientificChange

1. Normal Science

Scientists work within an accepted paradigm, conducting experiments and solving problems that fit the existing framework.

2. Anomalies

Researchersbegintodiscoverobservationsthatcannotbeexplainedbythecurrentparadigm.

3. Crisis

As anomalies accumulate, confidence in the existing paradigm weakens. Scientists start searching for alternative explanations.

4. ScientificRevolution

Anewparadigmemergesthatexplainstheanomaliesmoresuccessfullythantheoldone.

5. ParadigmShift

The scientific community adopts the new paradigm, fundamentally changing how scientists understand and investigate nature.

Example:TheCopernicanRevolution

A classic example is the replacement of the geocentric model of Claudius Ptolemy by the heliocentric model proposed by Nicolaus Copernicus. This shift transformed astronomy and changed humanity's view of the universe.

Incommensurability

Kuhn argued that different paradigms may be **incommensurable**, meaning they are based on different concepts and standards. As a result, scientists working within different paradigms may interpret the same evidence differently.

Significance

Kuhn's theory had a major impact on the philosophy and history of science. It emphasized that scientific progress is not always gradual and that major advances often occur through revolutionary changes in thought.

Summary

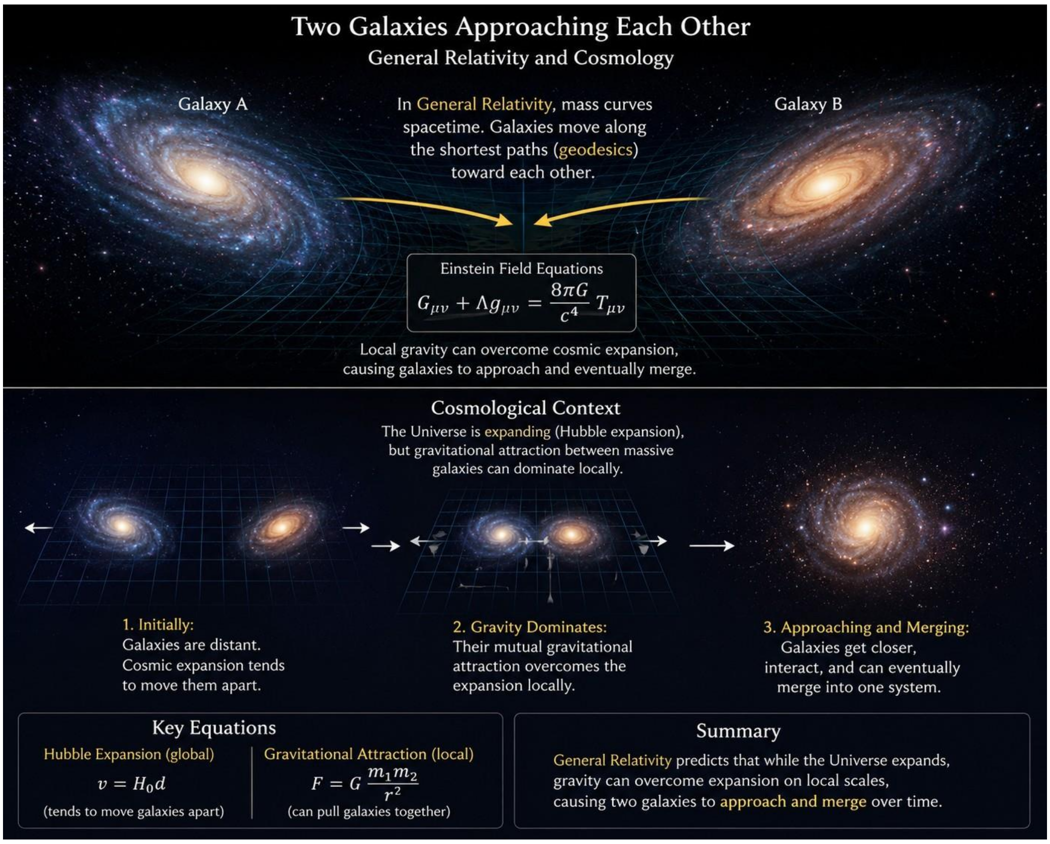
AccordingtoKuhn,scientificdevelopmentfollowsthispattern:

Normal Science → Anomalies → Crisis → Scientific Revolution → Paradigm Shift → New Normal Science

His central idea is that science advances through periodic revolutions that replace old paradigms with new ones, leading to profound changes in our understanding of the world.

TheoreticalFramework[1][6][7][8][9]:

In**GeneralRelativity**, twogalaxies can moveapartbecause **spaceitself isexpanding**.This is one of the foundations of modern astrophysics and cosmology.



GeneralRelativityandGalaxies

ThetheorydevelopedbyAlbertEinsteinin1915describesgravityasthecurvatureof spacetime caused by mass and energy.

Thefundamentalequationis:

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu}$$

ThisisknownasHubble'sLaw.

- v=recessionvelocity
- d=distancebetweengalaxies
- H0=Hubbleconstant

Example:

Iftwogalaxiesare100millionlight-yearsapartandH0≈70km/s/Mpc,theywillretreatfrom each other due to cosmic expansion.

AstrophysicalInterpretation

ObservationsbyEdwinHubbleshowedthatdistantgalaxiesexhibita**redshift**:

$$z = \frac{\lambda_{\text{observed}} - \lambda_{\text{emitted}}}{\lambda_{\text{emitted}}}$$

The greater the redshift, the faster the gobservatorio luciferalaxy is moving away.

Ageofthe Universe

Usingtheexpansionrate,astronomersestimatetheageoftheuniversetobeabout: billion years13.8 billion years

This value is supported by observations from the Planck spacecraft and other cosmological measurements.

ImportantPoint

General Relativity does **not** say galaxies are flying through space away from each other like bullets. Instead, the **space between galaxies expands**, increasing their separation over time. This is the basis of the modern **Big Bang Theory**.

For the analysis and analogy ofAlbert Einstein's Theory of General Relativity in the theory of Astrophysics and Cosmology, the Theory of Viscosity Fluids is used, the presentation of which will be given below:

Viscosity:

Viscosityisapropertyoffluids(liquidsandgases)thatmeasurestheirresistancetoflowingorbeing deformed.

BasicIdea

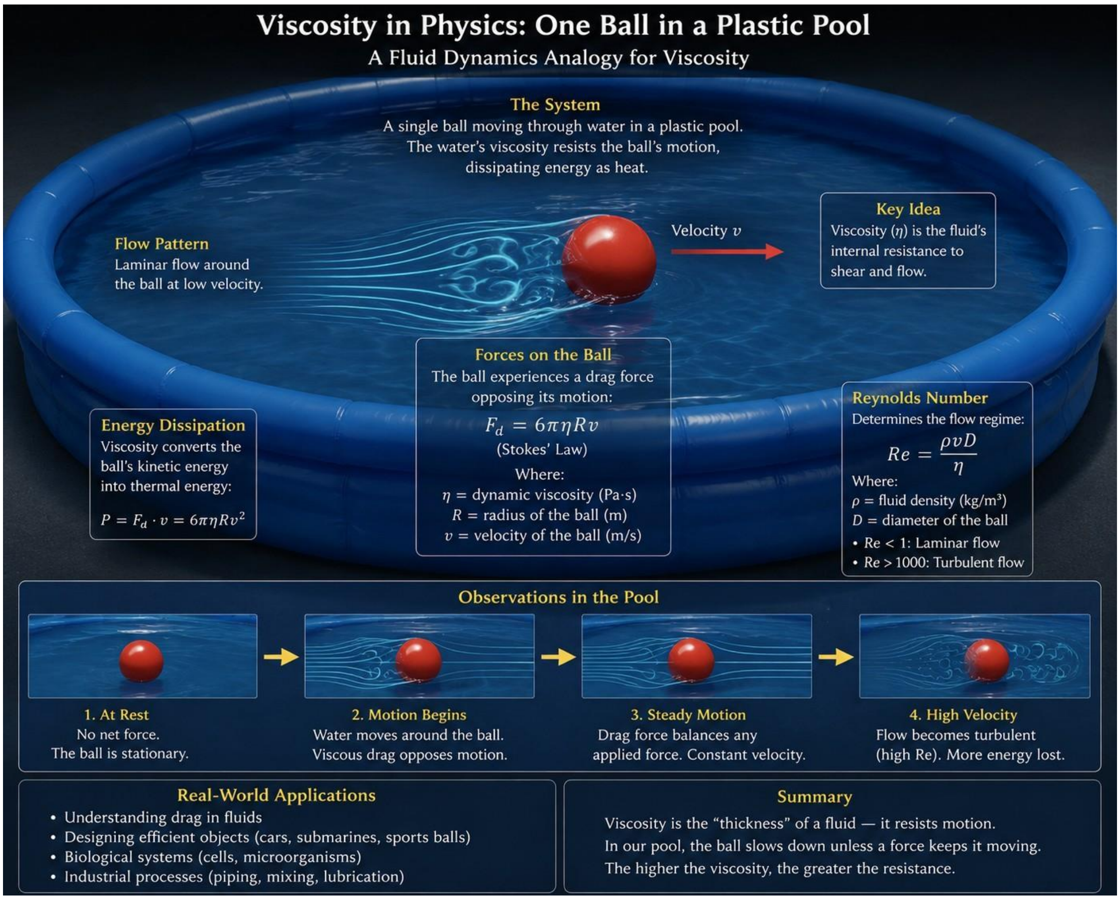
Afluidwith**highviscosity**flowsslowlybecauseitsinternalfrictionislarge. Examples:

- Honey→high viscosity
- Motoroil→medium viscosity
- Water→lowviscosity
- Air→very lowviscosity

WhatCausesViscosity?

Viscosityarisesfrominteractionsbetweenmolecules:

- In **liquids**, molecules attract one another, creating internal friction.
- In **gases**, molecules transfer momentum through collisions, producing resistance to flow.



When different layers of a fluid move at different speeds, viscosity acts to reduce the difference in velocity.

Example: A Ball in Water

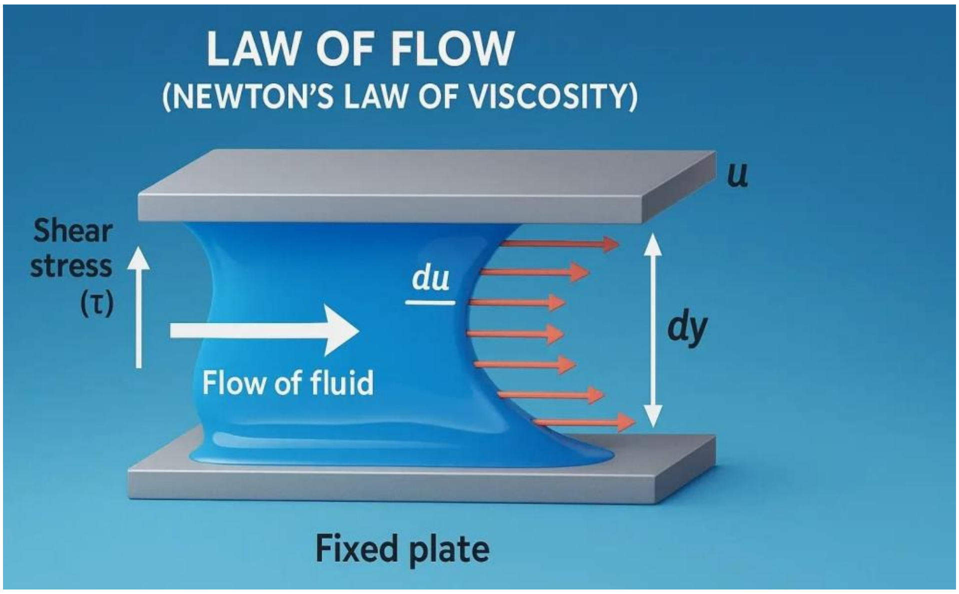
If a small ball moves through water:

- The water exerts a drag force on the ball.
- The drag increases with viscosity.
- The ball slows down because kinetic energy is converted into heat. For slow motion of a sphere:

$F_d = 6\pi\mu R v$

This is known as **Stokes' Law**, developed by George Gabriel Stokes.

Newton'sLawofViscosity



Formanyfluids:

$$\tau = \mu \frac{dv}{dy}$$

where:

- τ=shearstress(forceperunitarea)
- μ=dynamic viscosity
- dv/dy=velocitygradientbetweenfluidlayers

This equation states that the frictional force increases as adjacent layers move faster relative to one another.

Units

Dynamicviscosityismeasuredin:

Pa.s(Pascal-seconds)

Wateratroomtemperaturehasaviscosityofapproximately:

0.001Pa.s

Example:BallinWater

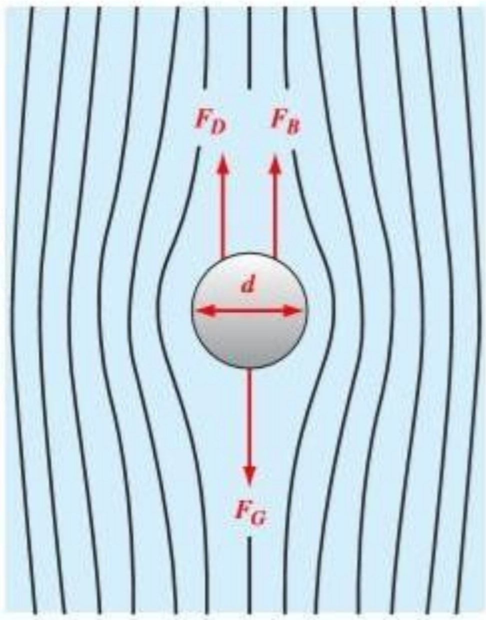


FIGURE P1.22

Whenaballmovesthroughwater,viscositycreatesadragforcethatopposesthemotion. For slow motion of a small sphere:

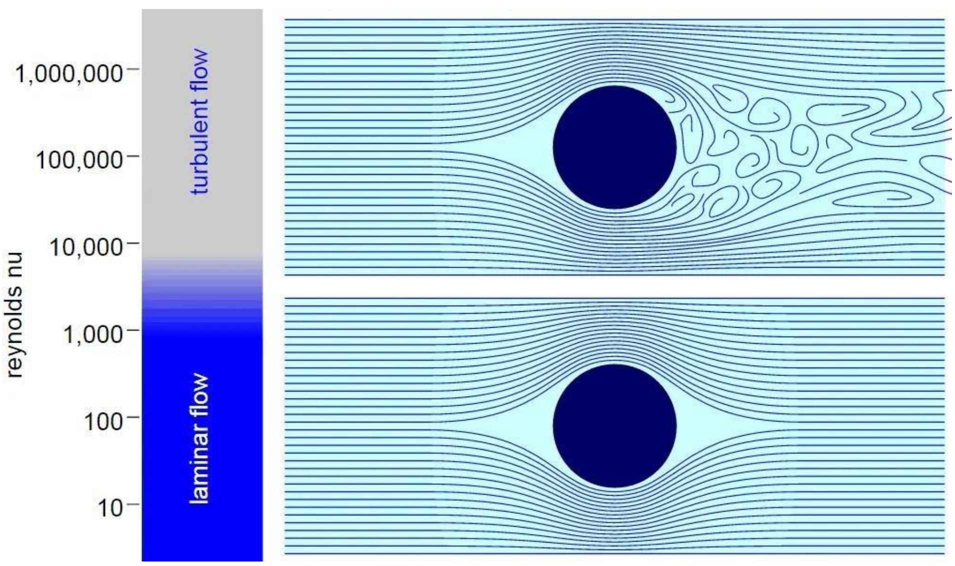
Stokes'law

F_d= 6πμRv

Ristheradiusoftheball. v speed of the ball

μviscosityofthe fluid6.

Reynolds Number



Viscosityalsodetermineswhetherflowissmoothorturbulent.

Re=ρvD/μ Low Re
laminar(smooth)flow High Re
turbulentflow

Viscosityisessentialin:

- Bloodcirculation
- Aircraftaerodynamics
- Ocean currents
- Lubricationinengines
- Planetaryatmospheres
- Accretiondisksaroundblack holes

SUMMARY

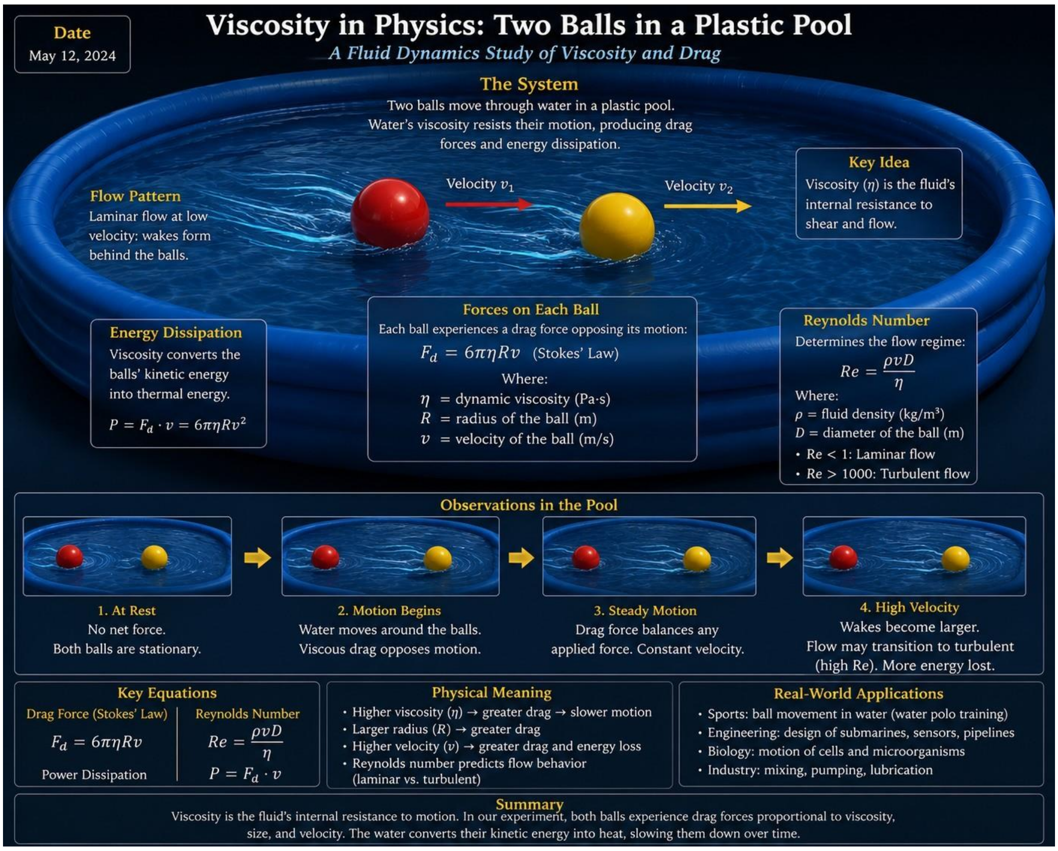
Viscosityistheinternalfrictionofafluid. Itresistsmotion,convertsmechanicalenergyintoheat, and determines how easily liquids and gases flow. Higher viscosity means greater resistance to movement and slower flow.

Applications

Viscosityisimportantin:

- Aircraftandautomobiledesign
- Bloodflowinarteries
- Oil pipelines
- Weatherandoceancirculation
- Lubricantsinmachinery
- Astrophysicaldisksaroundstarsandblack holes

Summary



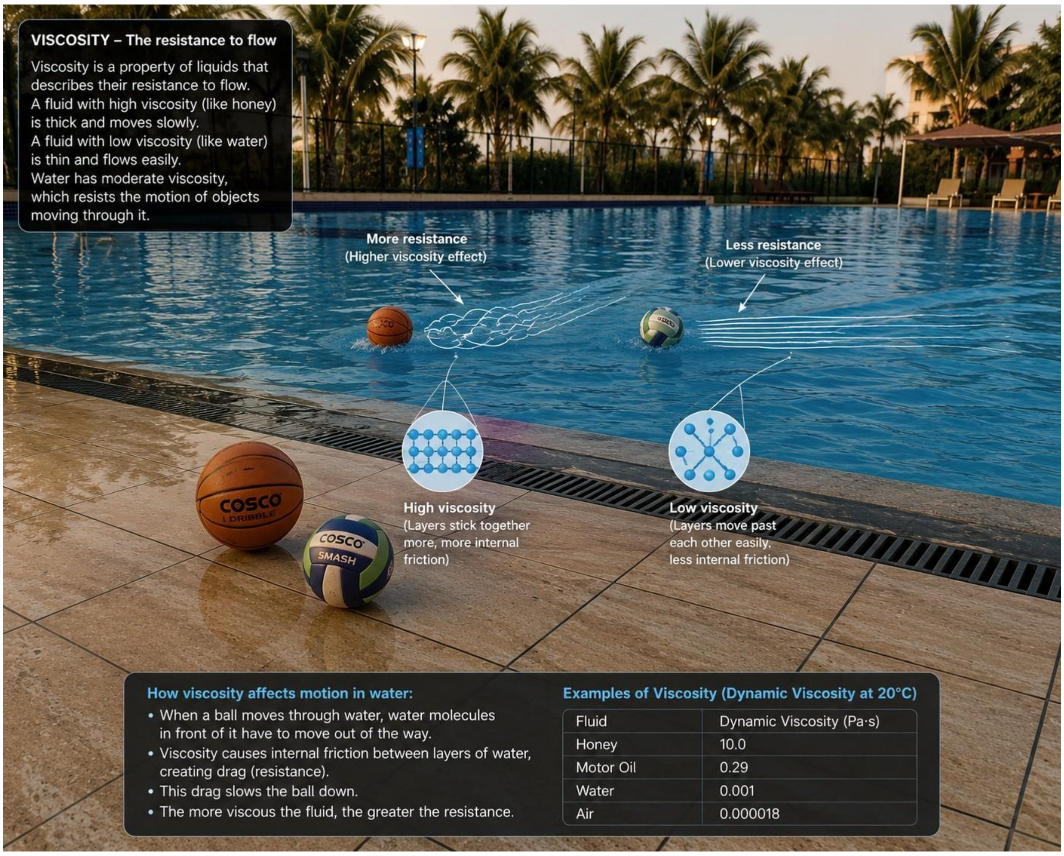
Viscosity is the **internal friction of a fluid**. It determines how easily a liquid or gas flows, how much drag objects experience while moving through it, and whether a flow remains smooth or becomes turbulent. It is one of the central concepts of **fluid mechanics**and**hydrodynamics**.

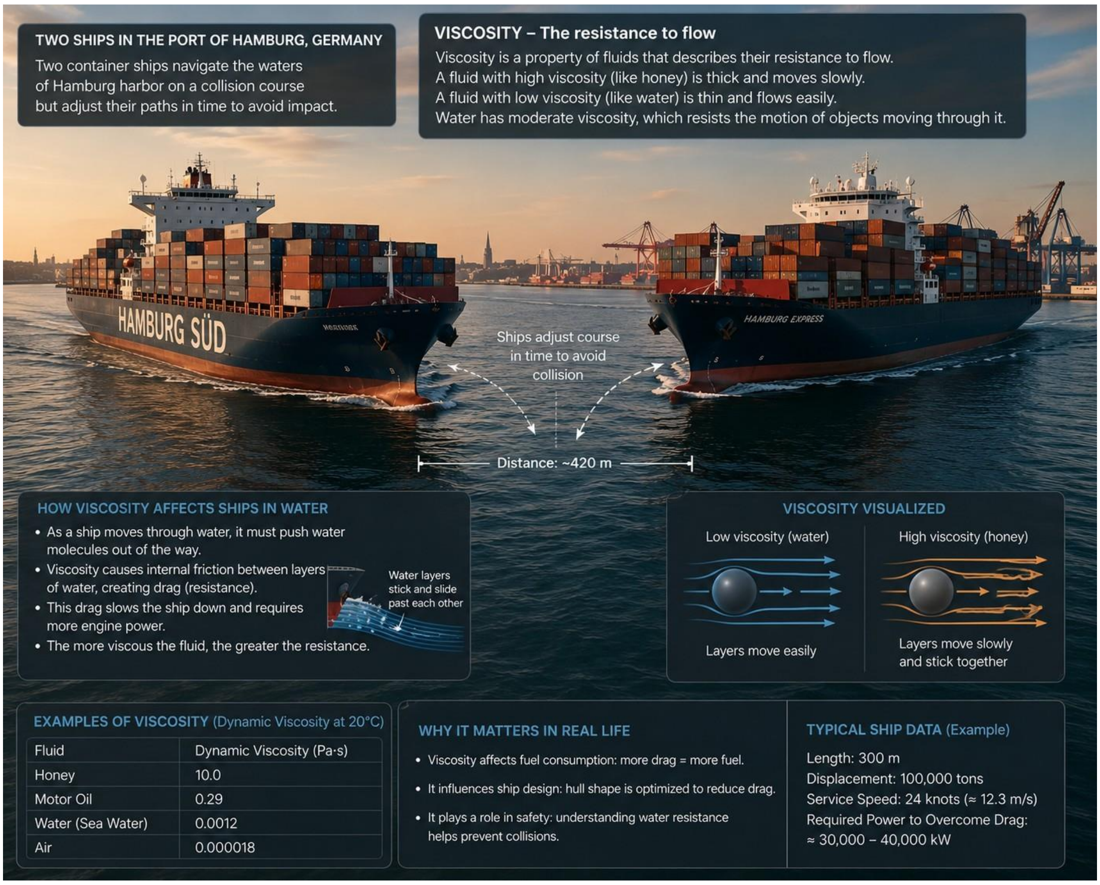
Physical Explanation

When one layer of fluid moves relative to another, molecules interact and produce internal friction. This friction opposes the motion and is called **viscosity**.

Imagineaswimming pool:

- Ifaplasticballmovesthroughwater,thewaterresistsitsmotion.
- Thisresistanceiscausedby viscosity.
- Theballloseskineticenergybecausesomeenergyisdissipatedasheat.


VISCOSITY – The resistance to flow
Viscosity is a property of liquids that describes their resistance to flow.
A fluid with high viscosity (like honey) is thick and moves slowly.
A fluid with low viscosity (like water) is thin and flows easily.
Water has moderate viscosity, which resists the motion of objects moving through it.
More resistance (Higher viscosity effect)
Less resistance (Lower viscosity effect)
High viscosity (Layers stick together more, more internal friction)
Low viscosity (Layers move past each other easily, less internal friction)
How viscosity affects motion in water:
• When a ball moves through water, water molecules in front of it have to move out of the way.
• Viscosity causes internal friction between layers of water, creating drag (resistance).
• This drag slows the ball down.
• The more viscous the fluid, the greater the resistance.
Examples of Viscosity (Dynamic Viscosity at 20°C)
Fluid | Dynamic Viscosity (Pa·s)
Honey | 10.0
Motor Oil | 0.29
Water | 0.001
Air | 0.000018


TWO SHIPS IN THE PORT OF HAMBURG, GERMANY
Two container ships navigate the waters of Hamburg harbor on a collision course but adjust their paths in time to avoid impact.
VISCOSITY – The resistance to flow
Viscosity is a property of fluids that describes their resistance to flow.
A fluid with high viscosity (like honey) is thick and moves slowly.
A fluid with low viscosity (like water) is thin and flows easily.
Water has moderate viscosity, which resists the motion of objects moving through it.
HAMBURG SÜD
Ships adjust course in time to avoid collision
Distance: ~420 m
HOW VISCOSITY AFFECTS SHIPS IN WATER
• As a ship moves through water, it must push water molecules out of the way.
• Viscosity causes internal friction between layers of water, creating drag (resistance).
• This drag slows the ship down and requires more engine power.
• The more viscous the fluid, the greater the resistance.
Water layers stick and slide past each other
VISCOSITY VISUALIZED
Low viscosity (water)
High viscosity (honey)
Layers move easily
Layers move slowly and stick together
EXAMPLES OF VISCOSITY (Dynamic Viscosity at 20°C)
Fluid | Dynamic Viscosity (Pa·s)
Honey | 10.0
Motor Oil | 0.29
Water (Sea Water) | 0.0012
Air | 0.000018
WHY IT MATTERS IN REAL LIFE
• Viscosity affects fuel consumption: more drag = more fuel.
• It influences ship design: hull shape is optimized to reduce drag.
• It plays a role in safety: understanding water resistance helps prevent collisions.
TYPICAL SHIP DATA (Example)
Length: 300 m
Displacement: 100,000 tons
Service Speed: 24 knots (≈ 12.3 m/s)
Required Power to Overcome Drag: ≈ 30,000 – 40,000 kW

CurvatureofSpace-TimeintheTheoryof Relativity[1][6][7]

The curvature of space-time is the central idea ofthe General Theory of Relativity, developed byAlbert Einstein in 1915.

AccordingtoGeneralRelativity:

- Space and time are not separate entities but form a four-dimensional structure called**space-time**.
- MassiveobjectssuchastheSun,Earth,andplanetsbendorcurvethespace-timearound them.
- Whatweperceiveas**gravity**isactuallythemotionofobjectsfollowingthecurved geometry of space-time.

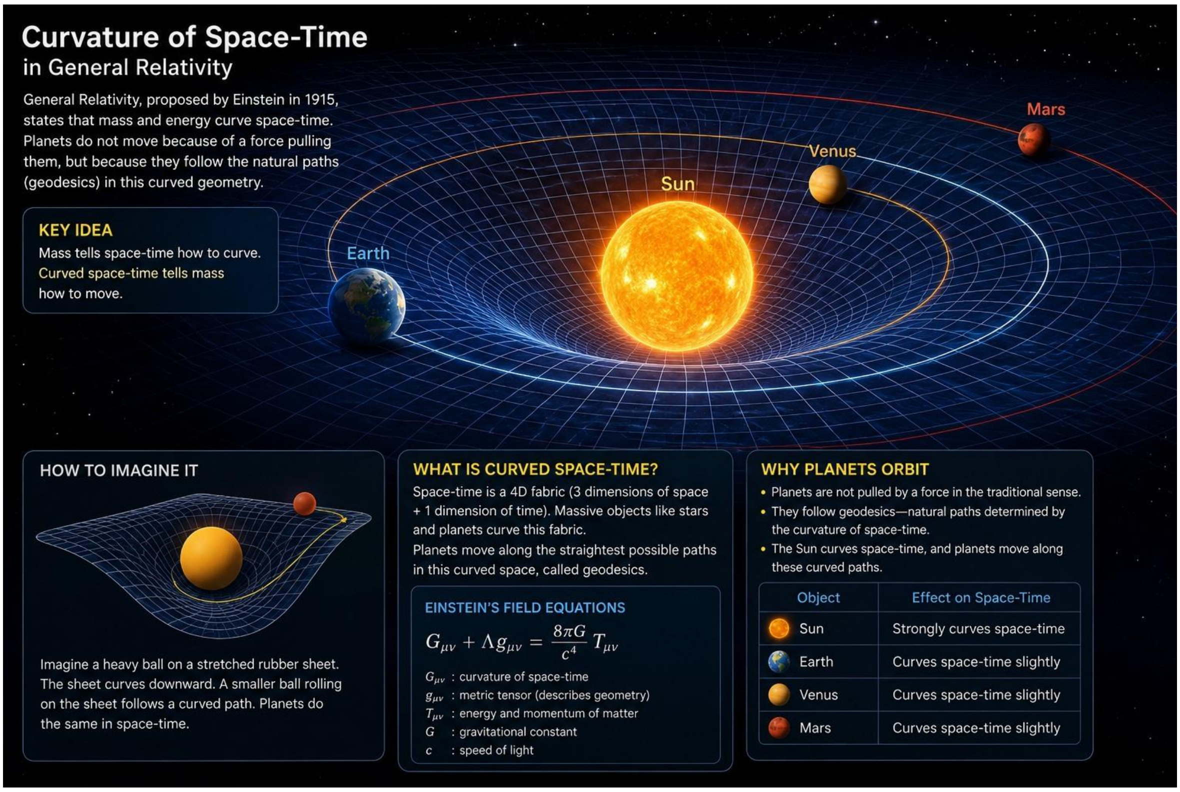
Einstein'sIdea

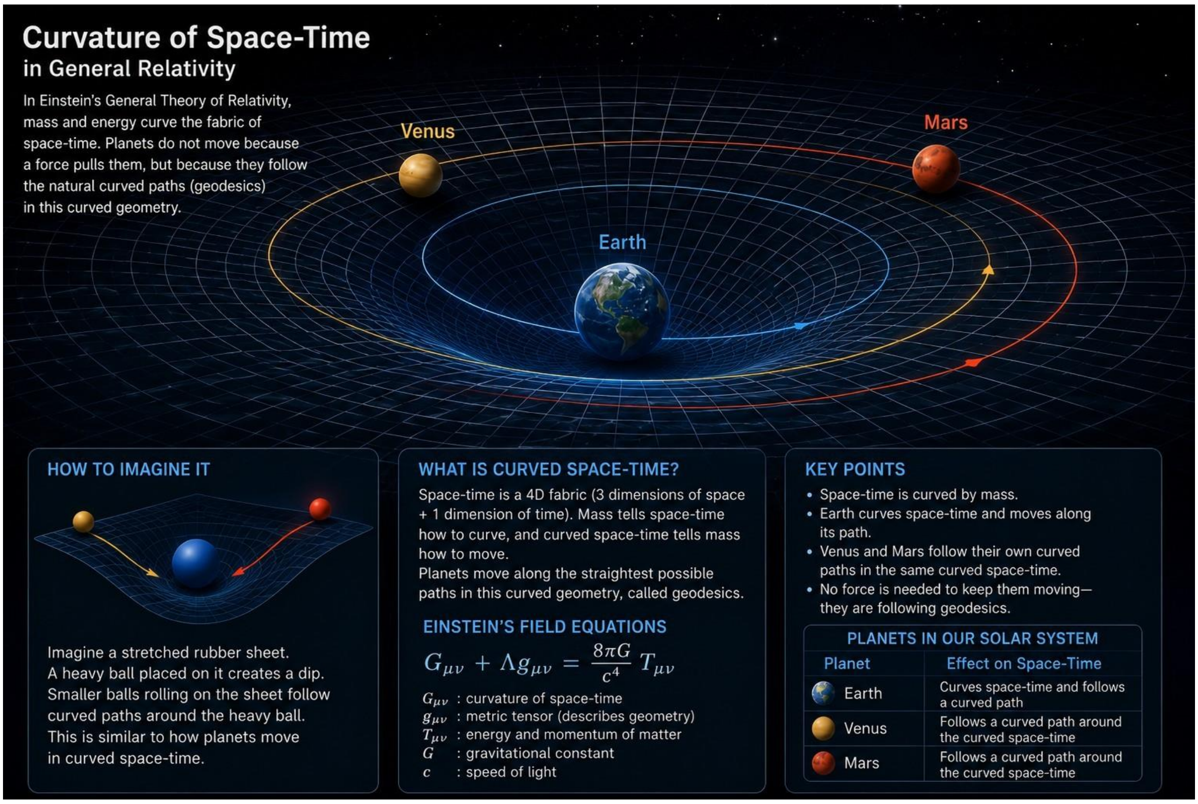
Einsteinsummarizedtherelationshipbetweenmatterandspace-timeas:

"Mattertellsspace-timehowtocurve,andspace-timetellsmatterhowtomove."

For example:

- The**Sun**createsadeepcurvatureinspace-timebecauseofitslargemass.
- The**Earth**movesaroundtheSunbyfollowingacurvedpathinthisdistortedspace-time.
- Thesameprincipleexplainsthemotionof**Mars**,**Venus**,moons,comets,andevenlight.





Visual Analogy

Imagineastretchedrubbersheet:

If a heavy ball is placed on the sheet, it creates a depression. Smaller balls rolling nearby move along curved paths because the surface is distorted.Although this analogy is only two-dimensional, it helps visualize how mass curves space-time.

EffectsofSpace-TimeCurvature

1. **PlanetaryOrbits**

- Earth,Venus,andMarsorbittheSunbecausetheymovethroughcurvedspace-time.

2. **GravitationalLensing**

- Lightbendswhenpassingnearmassiveobjectssuchasstarsorgalaxies.

3. **TimeDilation**

- Timerunsmoreslowlyinstrongergravitationalfields.

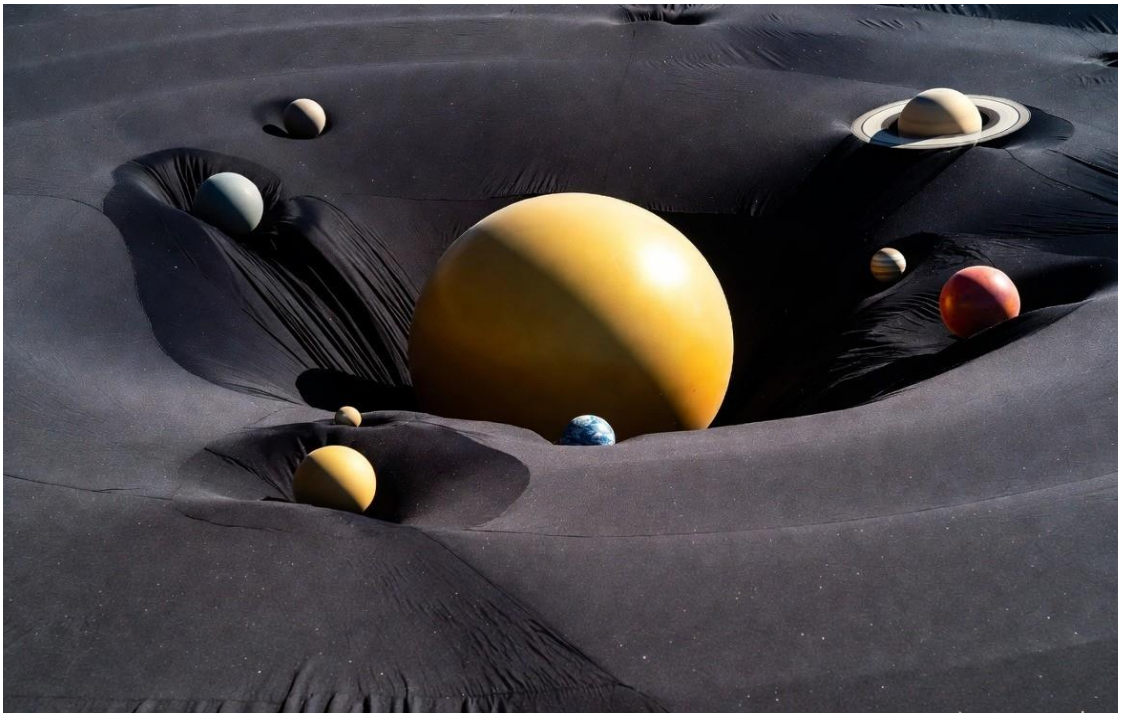
4. **Black Holes**

- Extremely massive objects can curve space-time so strongly that not even light can escape, creating a Black Hole.

CONCLUSION

In General Relativity, gravity is **not a force pulling objects together**. Instead, mass and energy curve space-time, and objects move along the natural paths within that curved geometry. The Sun curves space-time around it, and planets such as Earth,Venus, and Mars follow those curved paths, producing their orbits.

A common example used in teaching the Theory of General Relativity and the curvature ofspacetime.in a Curtain FabricResidential:



DISCUSSION

The purpose of this article is to discuss an analysis of the analogy between the viscosity theory of conceptual physics and the spacetime distortion of the theory of general relativity, in order to imagine if the theory of relativity...ofThe general statement would be TRUE or FALSE. The analogy of viscosity theory can be consideredaprototype,similar tothoseusedinarchitectureandcivilengineering,but with a conceptual teaching theory. It's important to remember that the approach was didactic and easily absorbed by the reader, as the complete theory can be found in textbooks. This article aims to provide easy comprehension for the teaching of Conceptual Theoretical Physics. Starting from the Viscosity Theory approach in University Physics, it emphasizes that...spostgraduate conditions have-ifNavier-Stokes Equationsfor fluids,in additionFrom the quantum mechanics of molecules to their behavior.With **definitions**,**axioms**,**conjectures**and**theoremsASTROPHYSICS and COSMOLOGY** It is possible to verify, through deductive means, the complexity of Conceptual Physics Theories, such as in the Teaching Theory ofGastonBachelard[13][14][15]:

"L'espritscientifiquenous interditd'avoiruneopinionsur desquestionsquenous ne comprenons pas, sur des questions que nous ne savons pas formular avec clarté. Avant tout, il faut savoir poser des problèmes. Et quoi qu'on dise, dans la viescientifique,lesproblèmesneseposentpasd'eux-mêmes.Thisisthesensthat poses a problem that gives rise to a veritable scientific spirit."(The scientific mind forbids us from having an opinion on questions we do not understand...Above all, one must know how to pose problems.And whatever people say, in scientific life, problems do not arise of their own accord.)

"La raison doit obéir à l'objet, tout en lui imposant ses formes."**(Reason must obey theobject, while simultaneously imposing its forms upon it.)**

"Lasciencemoderneestunesciencequin'apaspeurdescontradictions."**(Modern science is a science that is not afraid of contradictions.)**

In order to draw an analogy between the Theory of General Relativity and the Viscosity of Fluids, one can begin by analyzing the equations.Adidactic method is to compare the equations of the two theories in their respective environments, such as the fluid of a swimming pool or dark matter with its space-time distortion.The existence of dark matter needs to be definitively proven. Although scientists have much indirect evidence that it makes up about 27% of the universe, it has never been isolated or directly detected in a laboratory. Dark matter is invisible because it does not interact with light or any other electromagnetic radiation, being perceptible only through its gravitational force. Astrophysicists arrived at this theory from three major observations: Galaxy rotation, gravitational lensing.andSimulations of the Universe.

This question addresses the differentiation between spacetime distortion and dark matter (which needs to be proven), defining that...THE **dark matter** It is a mysterious and invisible substance that makes up most of the mass of the universe, while **space-time distortion.** It is the physical effect of deformation of the pThe very "fabric" of the universe (like a mattress sinking under a weight), caused by any object that possesses mass.The fundamental difference between the two concepts lies in the fact that...**dark matter** It is the "cause" (the invisible mass), and the **space-time distortion** It is the "effect" (the gravitational consequence of that mass). Light is an electromagnetic wave that travels through the vacuum of space at about 300,000 km/s. Phenomena such as **Doppler effect** and the **gravitational lenses** They prove that this light is stretched, shortened, and bent by cosmic movements and gravity, allowing us to map the universe.

1. PropagationofLightin Space

- **Noneedforamiddleman:**Unlikesound,whichneedsairorwatertopropagate,lightisan electromagnetic wave and travels perfectly in the vacuum of space.
- **Constantspeed:**Inavacuum,lighttravelsatthespeedlimitoftheuniverse(approximately299.79 2 km/s).

2. DopplerEffectinSpace

TheDopplereffectisthechangeintheperceivedfrequencyorwavelengthofawavewhen there is relative motion between the source and the observer. In a vacuum, it alters the color of starlight.

- **Redshift:**Ifastarorgalaxyismovingawayfromus,itslightisstretchedanditsspectrumshifts towards the color red.
- **Blueshift:**Iftheobjectisapproaching,thelightiscompressedandthespectrumshiftstowardsblue.
- **ExpansionoftheUniverse:**ThiseffectformedthebasisforthediscoverythattheUniverseis expanding.

3. GravitationalLenses

Gravitationallensesfunctionlikenaturaltelescopes.PredictedbyAlbertEinstein'sTheory of General Relativity, they occur because very massive bodies (such as black holes or galaxies) distort the fabric of spacetime around them.

- **Howitworks:**Whenthelightfromadistantstarorgalaxypassesnearthisenormousmass,itspath is bent.
- **Visualresult:**Lightcanbemagnified,distorted,orevengeneratemultipleimagesofthesame object, creating perfect rings or arcs in the sky.

MModelofTwoCollidingGalaxiesinAnalogytotheConceptualTheoryofViscosity:

With these concepts aboutWosmology of space-time distortionand the meaning of Dark Matterin comparisonwith the Theory of Viscosity from Conceptual Physics**viscosity**It is the physical property that measures a fluid's resistance to flow. It acts as "internal friction" between the fluid's layers when it is in motion, determining whether it is "thinner" (like water) or "thicker" (like honey).Some key words are: THE CAUSE and EFFECT of gravity and the curvature of spacetime (Dark Matter andSpacetime Distortion) andthe RESISTANCE of fluidVISCOSITY. Starting from the analysis of the comparison of equations, an analogy from Conceptual Physics for a reflection on the aspects of the equations, in their specific behaviors of Physical meanings, in this work the conceptual approach is the Physics of Fluids in University teaching, if addressing Quantum Mechanics. As an approach for teaching young people and, what can be said, a pre-analysis of the viscosity analogy before delving into the Concept of Quantum Mechanics of Molecules. This pre-analysis is useful for creating a prototype, and through the viscosity analogy, a model of two galaxies colliding is created.in the fact that the **dark matter** It is the "cause" (the invisible mass), and the **space-time distortion** It is the "effect" (the gravitational consequence of that mass).Concurrently with theviscosity theory describes **internal resistance** that a fluid (like water) offers to the flow.When a ball is in water, this property generates friction between the layers of the liquid and the surface of the object, creating a force opposing the movement.The process involves identifying what the analogy could be. Using the prototype or model...from the conceptual analysis ofphysicsBased onthetheory ofviscosity, acomputationalmodelis created, both forthetheoretical calculation as forThe graphical simulation, for a processor, is presented in a simple way, as explained in the introduction regarding the conditions of computers and processors.

Having theThetheory developed byAlbert Einstein in 1915describes gravity as thecurvatureof spacetime caused by mass and energy.

Thefundamentalequationis:

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu}$$

Newton'sLawof Fluids

Formanyfluids:

$$\tau = \mu \frac{dv}{dy}$$

OraReynolds'Law

Reynoldsnumber

$Re=\rho vD/\mu$ Low Re

laminar(smooth)flow High Re

turbulentflow

In epistemology, analogy functions as an essential cognitive mechanism for understanding, modeling, and justifying scientific and philosophical knowledge. It builds bridges between the familiar and the unknown, allowing the formulation of hypotheses based on comparisons of relationships between phenomena.The equations above justify the possibility of analyzing epistemology by creating a model for knowledge construction through an analogy between two theories: the Viscosity of Fluids and the Theory of General Relativity.The model would be derived fromthejustificationsoftheviscosityequationsusingAlbertEinstein'sequationfromtheTheoryof GeneralRelativity.describesgravityasthecurvatureofspacetimecausedbymassandenergy.From this, with the appropriate Astrophysics book, such as an example in [16] it is possible to construct theconcepts ofthemodels whichaccordingtodefinitions,theorems,conjectures andaxioms raisea deductive hypothesis.The outcome of the knowledge model of epistemology's analogy in the construction of knowledge proposed in the article is therefore deductively derived. Thus, the outcome of the model of theoretical calculations and computational simulation is formed within the epistemological model.

TheRoleofAnalogyinKnowledge Construction

- **Explanationoftheinvisible:**Whenfacedwithphenomenainaccessibletodirectexperience, analogy suggests paths to understanding.
- **Scientificmodeling:**Modelsareoftenconstructedbyanalogy(e.g.,theanalogyofthebrainwitha computer).
- **Conceptbuilding:**Itservesasanamalgamforstructuringnewtheories,connectingalready established notions to new perceptions of reality.

EpistemologicalLimitsandCritiques

Despitetheirheuristicusefulness,theuseofanalogiesinepistemologyrequiresrigor,astheycarry risks:

- **Epistemologicalobstacles:**AsphilosopherslikeGastonBachelardhavepointedout,excessive analogies can generate false images that hinder scientific progress.

• **Provisional:**Ananalogydoesnotconstituteformalproof,butratheranindicationthattwothings share characteristics, which often supports...**arguments by analogy** and **inductive reasoning.**

CONCLUSION

Therefore, a hypothesis for analyzing the Theory of General Relativity in a didactic manner is concluded.in order to build knowledge of the Conceptual Physics of Epistemological Conceptionsof Teaching Philosophy, breaking through epistemological obstaclesThis article uses Albert Einstein's Theory of General Relativity to help understand Astrophysics and advanced Cosmology in higher education. It emphasizes that this article serves as a brief approach and abstraction of the concepts of the Theory of General Relativity, along with the Theory of Viscosity from Fluid Mechanics, in the construction of advanced theoretical calculations and possibilities for computational simulations of the behavior of the Theory of General Relativity in Cosmology and Astrophysics.

BIBLIOGRAPHIC

1. General Theory of Relativity (1915):Einstein, A. (1915). Zur allgemeinen Relativitätstheorie.*Sitzungsberichte der Königlich Preußischen Akademie der Wissenschaften*, 778-786.
2. https://www.ligo.caltech.edu/news/ligo20160211
3. https://comunidadeculturaearte.com/entrevista-vitor-cardoso-a-minha-preocupacao-de-futuro-e-saber-que-talento-novo-vou-estar-a-acarinhar-esperando-que-venha-a-ser-mais-inteligente-do-que-eu/
4. https://www.astronomy.com/science/lucifer-allows-astronomers-to-watch-stars-being-born/
5. https://www.cnnbrasil.com.br/tecnologia/cientistas-realizam-simulacao-mais-longa-de-fusao-de-estrelas-confira/
6. Albert Einstein.*Relativity: The Special and General Theory*. Translated by Robert W. Lawson, Henry Holt and Company, 1920.
7. General Relativity Comprehensive Paper (1916):Einstein, A. (1916). Die Grundlage der allgemeinenRelativitätstheorie[TheFoundationoftheGeneralTheoryofRelativity].*Annalen der Physik*, 354(7), 769-822.
8. Pritchard, P.J., & Mitchell, J.W. (2015).*Fox and McDonald's introduction to fluid mechanics*(9th ed.). John Wiley & Sons.

9. Çengel,Y.A.,&Cimbala,J.M.(2017).*Fluidmechanics:Fundamentalsandapplications*(4th ed.). McGraw-Hill Education.
10. Piaget,J.andInhelder,B.(1969)ThePsychologyoftheChild.BasicBooks,NewYork.
11. Vygotsky,L.S.,&Luria,A.(1994).ToolandSymbolinChildDevelopment.InR.VanDer Veer, & J.Valsiner(Eds.),TheVygotsky Reader. Oxford: Blackwell Publishers.
12. Kuhn, Thomas S. 1970.The Structure of Scientific Revolutions. 2nd ed. Chicago: University of Chicago Press.
13. Bachelard,G.(1964).*Thepsychoanalysisoffire*(ACMRoss,Trans.).BeaconPress.
14. Bachelard, G. (1969).*The poetics of reverie*(D. Russell, Trans.). Beacon Press.
14. Bachelard, Gaston. 2014.*The Poetics of Space*. Translated by Maria Jolas. London, England: Penguin Classics.
15. Duric,Neb.AdvancedAstrophysics.Cambridge:CambridgeUniversityPress,2004.