

Beyond Relativity and Quantum Mechanics: Space Physics

Why We Have No Physical Cosmology, and How to Start
Creating One

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Which Physics Do You Want?

- A. A physics that only models and predicts the **experiences of the observer**—his sensations and measurements?

OR

- B. A physics that models **the Cosmos** and creates and tests **theories** about the **nature** and **causes** of all **phenomena**?

Which Physics Do We Have?

We Have:

A. Observer-Based Physics

Axioms:

- **Absolute c:** The **velocity** of light is a **law of nature**: light moves at **c relative** to every **observer** or coordinate system (CS).
- **The Special Principle of Relativity:** Relates all “laws of nature” to **observers** (CSs) moving uniformly relative to each other.
- **The General Principle of Relativity:** Relates all “laws of nature” to **any observers** (CSs), including accelerating and rotating observers.
- **Quantum Mechanics:** Relates all “laws of nature” to **observers’** perceptions; views the interactions of **observer** and **object** as the **ultimate reality**

Eisberg, R., Resnik, R., *Quantum Physics*, 88 (1974)

The “laws of nature” are mathematical correlations of observers’ measurements!

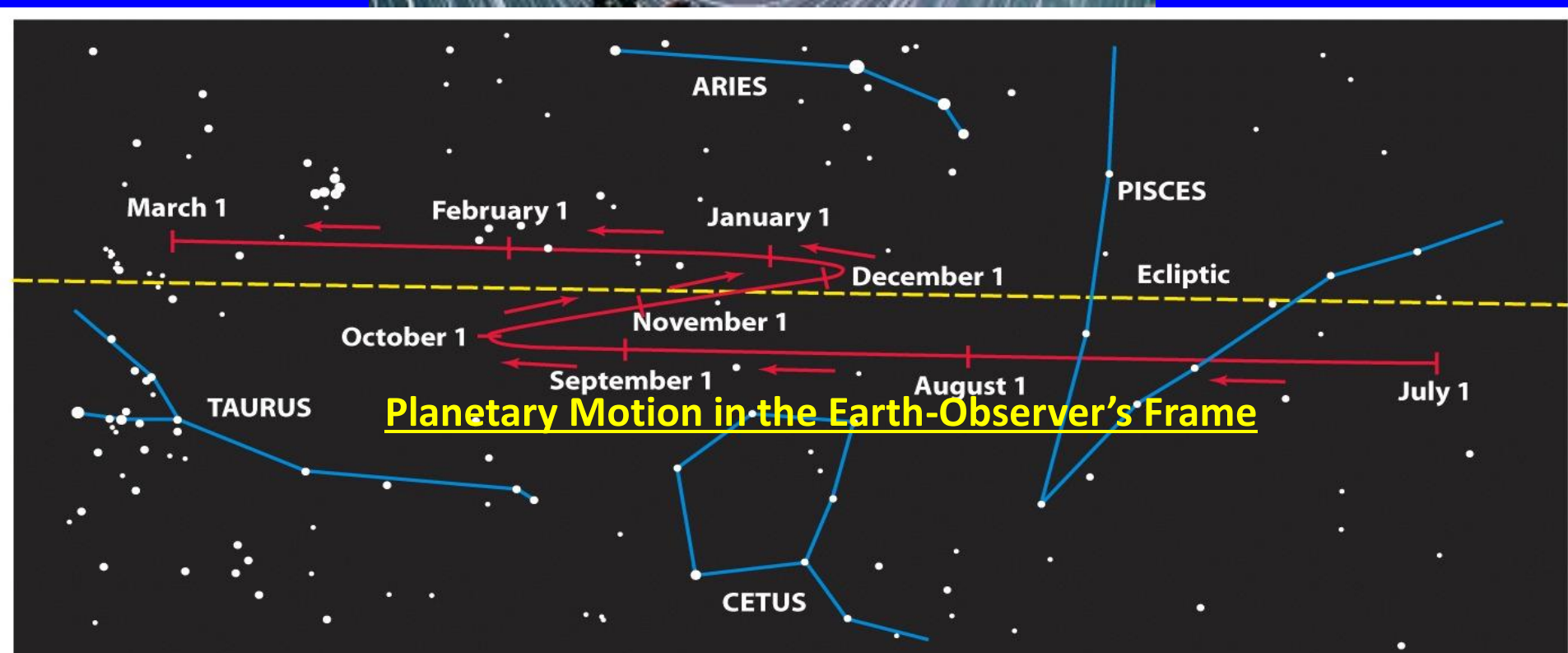
What's Missing in "Modern Physics"?

- **The Cosmos**—there are only **observers** and their **CSs** (frames), their experiences and measurements.
- **Objective-Cosmic frame(s)**: e.g. in which light **physically** moves at **c** , etc.
- **Hypotheses** concerning the **nature** of space, matter or light
- **Theories** about the **causes** of any fundamental phenomena:
 - What **causes** light to always move at **c** , regardless of the velocity of its source?
 - What **resists** the acceleration of matter and **prevents** matter from moving at **c** ?
 - What **causes** the transverse Doppler **redshift** of the spectra of atoms in motion or in gravitational fields? (a.k.a. "time dilation")
 - Relative to what is **rotation absolute**? How?
 - What **causes** gravity?
 - What is **energy**? A substance? Motion?

The "laws of nature" have **no** explanation, everything is **MAGIC!**

We've been here before!

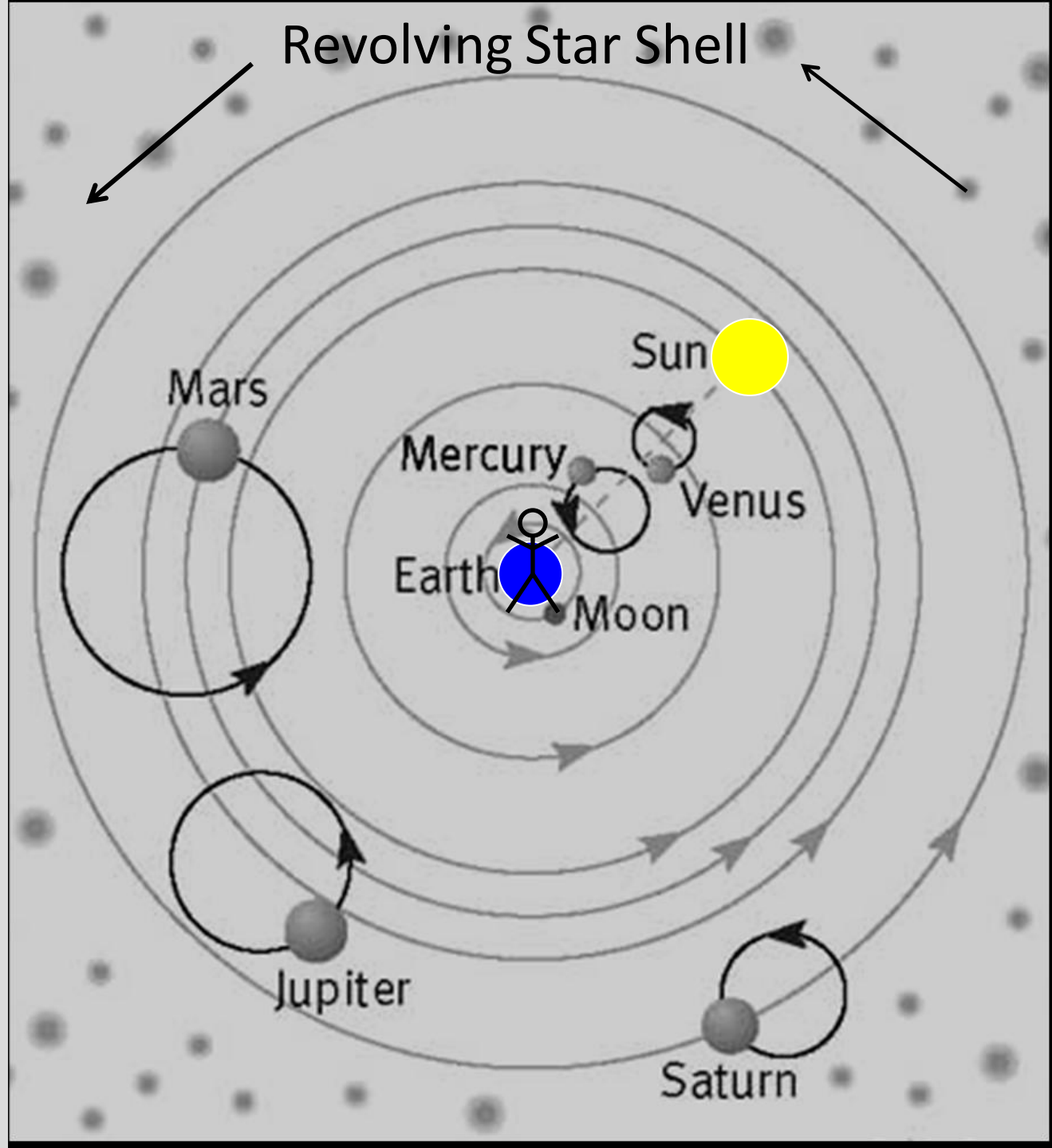
Observer-based Cosmology



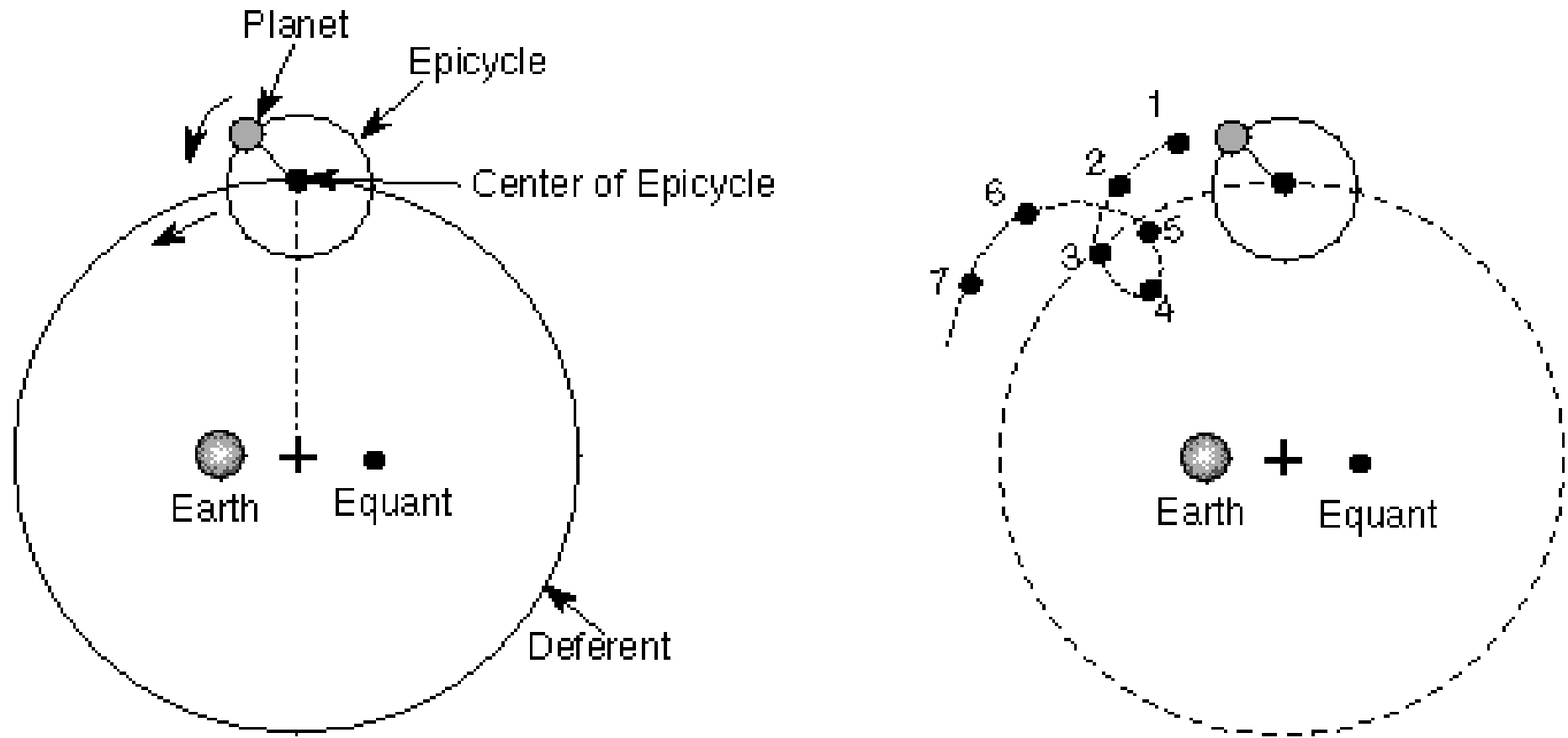
The Cosmos
revolves around
us.

Ptolemaic Cosmology

Earth-observer
model



The Math was Complex, but Worked!



Deferents, epicycles and equants described the observer's experiences and measurements; but had **no physical reality**

Philosophy: Beyond Consciousness to Cosmos

- **Copernicus** replaced the **observer's frame** with a **Cosmic frame**
- The Earth's motion was **not** evident to the senses; it was evident to the **mind**—it was a **theoretical construct** necessary to **explain** our experiences.
- The **Copernican Revolution** was an act of **philosophical cognition**.
- **Philosophy**: We create **theories** that allow our minds to reach beyond our **consciousness** (experience) to an understanding of the **Cosmos**.
- **Theoretical physics** requires a similar **philosophical revolution** today.

Classical Physics was Ether Physics

- To explain motion, Newton posited **absolute space**—an single Cosmic Euclidean ether necessary to explain inertia, rotation.
- Newton believed that all matter had a **definite velocity** in this space, even if it could not be determined. *Principia*, Definitions, Scholium, para. 9 (1686).
- Maxwell modeled light as **waves** in the ether, created mechanical models of the ether.
- Lorentz believed that light moved at **c** in the ether, and produced his **transformations** based upon his theory of electrons in motion in the ether.
- Lorentz **explained** the null Michelson-Morley experiments as due to a physical length contraction in the direction of motion.
- What happened to this physics that sought the **causes** of phenomena?

Religion against Philosophy

- **Bishop Berkeley:** Copernicus' and Newton's ideas threatened to **replace religion** with **natural philosophy** - to replace God with **Cosmic** causation.
- **Subjective Idealism:** Since we know only our own conscious **experiences** and have no **direct** knowledge of any **material Cosmos**, we must not assume that it exists.
Principles of Human Knowledge (1710) body, para. 18
- **Berkeley: Consciousness** is a virtual reality **simulation** supplied to our **spirits** and coordinated by **God**. See the movie: **"The Matrix"** (1999)
- **Subjectivistic Science:** Merely **describes** and **models** our **experiences**.
- **Mathematical Science:** Seeks the **quantitative "laws"** that **govern** our experiences and measurements.
- **Everything is Magic: God** makes it all happen; **no need** for Cosmic causes.

David Hume

“Enlightenment” “Philosophy”

- **Denied** that we could know any Cosmic causes
- Our **belief** that an **effect** will follow from a **cause** is merely a “**custom**” we have acquired through repetitive **experience**.
- **Denied** that we could ever **know** the **cause** of such a “**custom**” as **gravity**.

An Enquiry Concerning Human Understanding (1748)

Ernst Mach's Positivism

- Admitted the influence of **Berkeley** and **Hume**
- **Subjectivist**: “*The world consists only of our sensations*”
Ernst Mach, *Analysis of Sensations*, 12 (1897)
- **Redefined** physical theories as **quantitative instruments**—mathematical tools for reproducing and predicting **observations**.
- **Refused** to believe in **atoms** (*circa* 1900) because they were not **evident** to our senses.
- **Positivism** was the dominant ideology in **Science** at the start of 20th century.
- **Science** today remains **positivistic**, is **opposed** to **philosophy** (explanatory theory).

The Origins of Relativity

- **Bishop Berkeley:**

- We must treat **motion** not as absolute, Cosmic, or real but as **merely relative** to ourselves **or** to other objects in our **consciousness**, and treat **time** as the mere **succession of events** in our **consciousness**.

Principles of Human Knowledge para. 112., para. 98 (1710)

- **Ernst Mach:**

- Newton's theory of absolute space and motion was "devoid of content", since we only know "**relative spaces** and **motions**". Mach called those who shared his view "**relativists**".

The Science of Mechanics, 283, 293 (1883)

Albert Einstein

- **Philosophical:** had read **Berkeley**, admitted influence of **Hume** and **Mach**
- **Subjectivist:** *“The only justification for our concepts...is that they serve to **represent** the complex of **experiences**; beyond this they have **no legitimacy**.”*

Einstein, *The Meaning of Relativity*, 2 (1922)
- **Mathematical idealist:** *“Nature is the **realization** of the simplest conceivable **mathematical ideas**.”*

Einstein, *Ideas and Opinions*, 274 (1954)
- Relativity rendered the historic struggle between the views of Ptolemy and Copernicus *“**quite meaningless**”* since *“**Either CS** could be used with **equal justification**.”*

Einstein and Infeld, *The Evolution of Physics*, 224 (1938)
- **Theist:** God is *“a superior **mind** that **reveals** itself in the **world of experience**.”*

Einstein, *Ideas and Opinions*, 262 (1954)

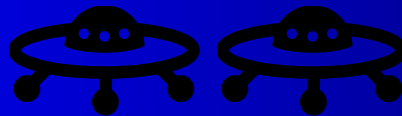
Einstein Created “Modern Physics”

- Einstein’s **1905** papers on **Special Relativity** and the **lightquantum** created a physics based upon **idealism** and limited to **subjectivistic modeling**.
- His “lightquantum” became the foundation of **Quantum Mechanics**.
- Like Mach: He **denied** the existence of **ether** and of **light waves** because they were not **directly** evident to the **senses**.
- He eliminated **physical causality** from physics, replacing **causes** with **ideas** that helped to **model experience**.
- He instituted the **Berkeley-Mach program**—replacing explanatory natural **philosophy** with descriptive **Science**.

Does Relativity Work?

No: Twin Paradox

Relativity means, literally, that all **motion** is **merely relative** to **any arbitrary** frame of reference.



But: “frames” in relative motion have **identical trajectories** in **each other’s CSs!**

A **third frame** is required to **break** the **symmetry!**

(The Cosmos, luminal ether, inertial space, etc.)

Relativists must introduce a third frame **surreptitiously.**

Subjectivistic models cannot be used to explain **Cosmic** reality!

Is this problem solved by General Relativity?

No. Relativity Was Not Generalized

- Realizing that SR required a **third frame**; Einstein tried to eliminate it by “relativizing” **acceleration, rotation** and **gravitation**! He tried to relate the “laws of nature” to accelerating and rotating observers!

- **The General Principle of Relativity:** “All bodies of reference K, K' , etc. are **equivalent** for the description of natural phenomena (formulation of the general laws of nature), **whatever** may be their state of motion.”

Relativity, The Special and General Theory, 61 (1961)

- **But:** **Matter** causes **gravity**, the **distribution** of **matter** determines the inertial/rotational **frame!** **Motion** in this **Cosmos** is **never** merely **relative**.
(Remember Copernicus)
- **Ad Hoc Fix:** Relativists relate GR's ideas or equations only to **Cosmic CSs:** those of the **near** and/or **distant celestial bodies**.
- They apply **subjectivistic** Relativity in an **objectivistic** way.

GR Became an Ether Model (in a way)

Einstein **realized** that he had again **failed** to **eliminate** the **ether** :

*“According to the general theory of relativity **space** is endowed with **physical qualities**; in this sense, therefore, **there exists an ether**...But this ether may **not** be thought of...as consisting of **parts** which may be tracked through **time**. The idea of **motion** may **not** be **applied** to it.”*

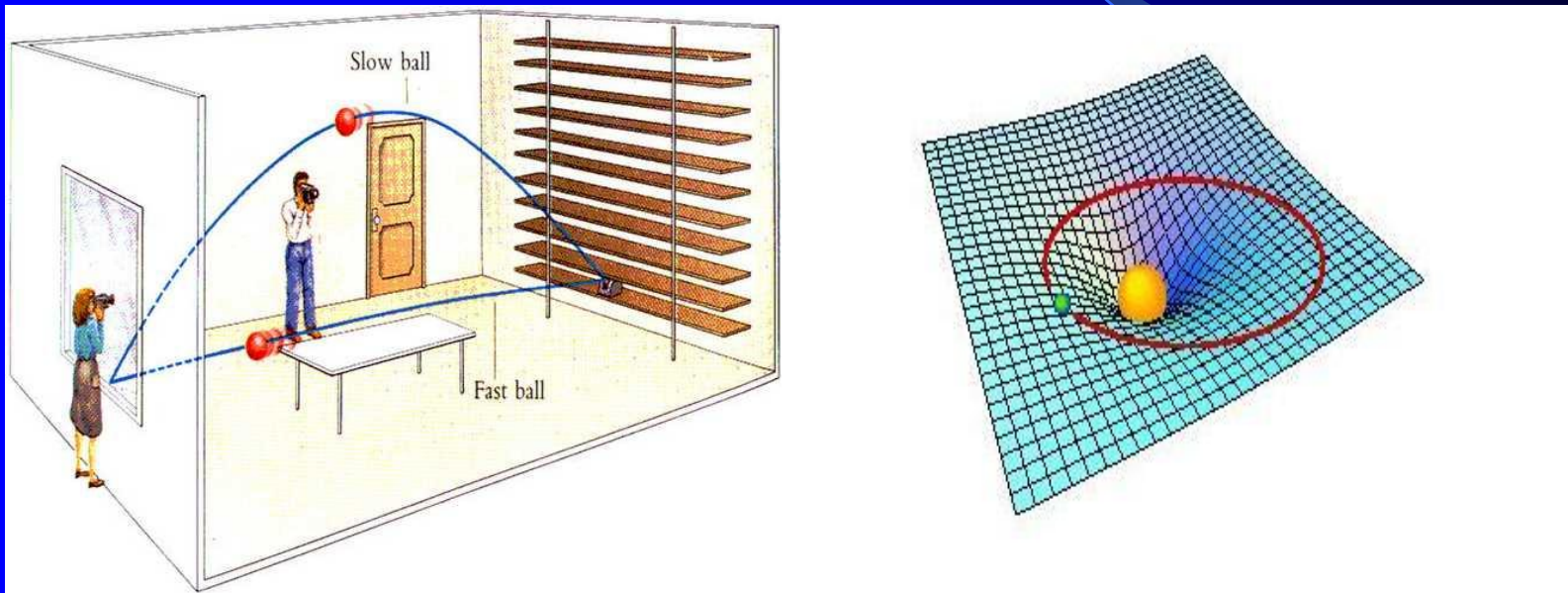
Einstein, “Ether and the Theory of Relativity” (1920)

Einstein should have **abandoned** the **Relativity program**.

No parts, no motion: he **forbade** scientists to theorize about **ether-space**!

Space-Time Misunderstood

“The space-time curvature around the Earth acts on fast or slow balls in exactly the same way. *It tells these balls how to move.*”



No. GR's **field equations** describe how the **observers'** measured space-time intervals are **altered** by the presence of a **gravitational field**.

Space-time **describes** the **effects** of gravity.

Space-Time is Subjectivistic

$$ds^2=c^2dt^2-(dx^2+dy^2+dz^2)$$

- Composed of the **intervals** that observers measure between “**events**”; the **one thing** they can agree upon when **c is absolute** for **each**.
- **Not a Cosmic model:** Light travels at **c** in **every observer’s frame!**
- A model of **consciousness**; of the rules of the **Berkeley’s Matrix**
- **Epistemologically equivalent** to Ptolemy’s **deferents, equants**, and **epicycles**.
- Einstein: *“The chronotropic interval has no physical meaning or significance.”*

quoted by T. Levi-Civita, Nuovo Cimento, **13**, 45 (1936)

Relativity: Ideas Became Causes!

- **Relativity begins** with **subjectivistic measurement concepts**:
 - **Space** is the number of the observers' measuring **rods**
 - **Time** is a number of ticks of the observers' **clocks**
 - **Mass-energy** is a just a measurement
- **Lacking any objective frames or Cosmic causes**, these **observers' measurement-concepts** became **causes!**
 - **Space-Time** became the "**fabric of the Cosmos**" and **cause of motion**.
 - **Time** became a mysterious **thing** that stops, runs slower, backwards.
 - **Mass-Energy** became a mysterious **force** or **power**.

Everything is **MAGIC!**

Platonic idealism; not **Cosmic theory!**

The Contradiction and Confusion

- **Inconsistency:** Einstein admitted that in the field of **epistemology** he had been an “**unscrupulous opportunist**”, resorting to **realism, idealism, positivism**, and **Platonism** as the situation seemed to require.

Albert Einstein: Philosopher-Scientist, p. 684

- Often spoke of “physical reality”, “causes”, etc. when he meant “**ideas**” that help to organize our **perceptions**.
- Subsequent physicists were **not** philosophers, they have not been able to **understand** or **replace** Relativity and QM.
- Physicists remain caught between their own **natural objectivism** and the **subjective idealism** of Relativity and QM.
- They try to use **Relativity** and **QM** to **model** and **explain** the **Cosmos**, not realizing that these models were **not** created for that **purpose!**

A New Metaphysics for a New Physics

Instead of idealism:

Cosmism: The **Cosmos exists**. We **humans** and our language-enhanced **consciousness** are **products** of its **evolution**. Our experiences **result** from the **interaction** of our sense organs and instruments with the rest of the Cosmos.

Cosmism is a **philosophical** theory—the **best explanation** of our existence and experiences.

A New Epistemology for a New Physics

Cosmism implies objectivism:

- **objectivism:** Knowledge consists of our **descriptions** and **models** of the **Cosmos**.
- **objectivistic modeling:** We relate regularities in our experiences and measurements to **Cosmic entities** and **CS(s)**. The result is a **model** of the **Cosmos**.

Only **objectivistic** models can form the basis of **causal-Cosmic theories!**

Replace SR with a Modified Newton-Lorentz Ether Theory

- Relativity **doesn't** work, doesn't "cause" anything and isn't "proven" — what works are the **Lorentz Transformations**—when applied in the **correct Cosmic frame!**
- **Newton-Lorentz ether theory** contains the physical space that **causes** the Newtonian-inertial and Lorentzian-electromagnetic ("relativistic") effects.
- **Cosmic-objectivistic model: No more MAGIC!**
 - Light moves at **c** in **space**
 - Atomic spectra are **redshifted** by velocity in space (not "time dilation")
 - Space **resists** the acceleration of matter
 - Space **prevents** matter from moving at **c**, etc.

How is this space related to matter? What happens to it in gravity?

Replace GR's "Space-Time Curvature" with Spatial Flow

- Einstein realized that being **accelerated** by a **rocket** in deep space was similar to sitting on a **planet's** surface (**Principle of Equivalence**).
- **Implication:** Both forms of acceleration have the **same cause: acceleration** with respect to **space**.
- **Implication:** Newton's inertial **ether-space** must itself be **accelerating** radially **Earthward** ($a=GM/r^2$)
- If space is a **substance** that is accelerating Earthward, it must also have a **velocity!**

Gravitational Velocity

- The velocity will be the sum of the total acceleration from **rest at infinity** to that radial **distance r** :

$$v = \sqrt{2GM / r}$$

- This is identical to the Newtonian **escape velocity**
- At the Earth's surface, space is flowing at **11.2km/s**.
- This velocity directly and simply produces the **gravitational redshift** and the **Schwarzschild radius** of black holes (**velocity of space = c**) !

$$\Delta f / f = 1 - \sqrt{1 - 2GM / rc^2} \quad R_s = GM / c^2$$

- **Unifies** inertial and gravitational transverse Doppler **redshift** ("time dilation"): always caused by **velocity in space**.

The physical basis of “space-time curvature”

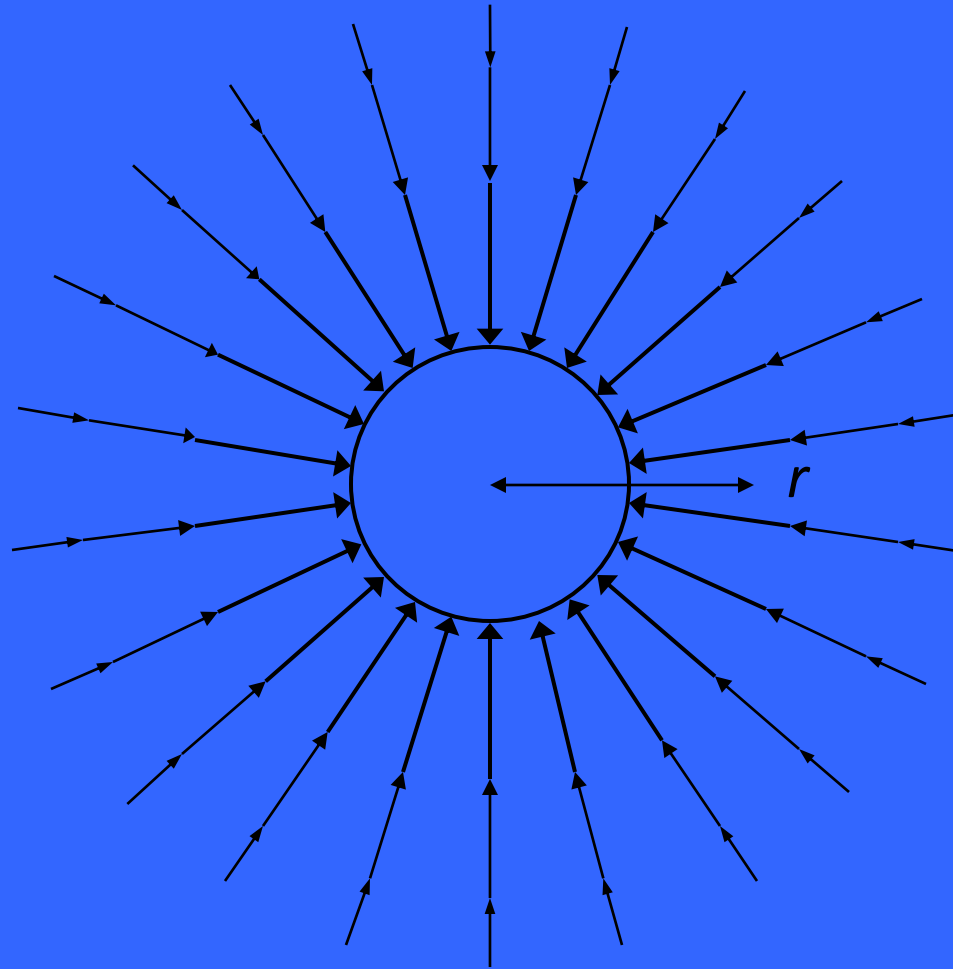
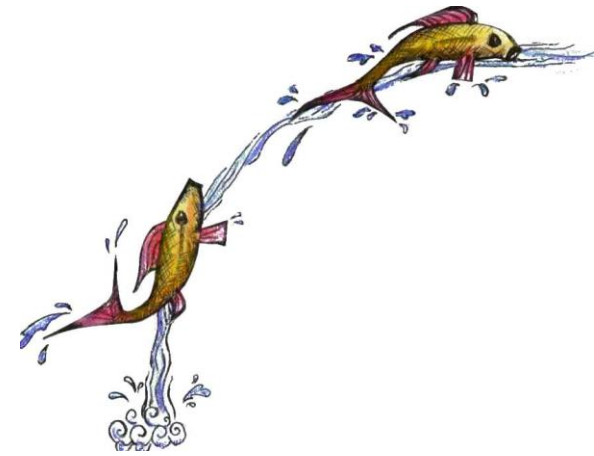


Figure 1. Two-dimensional representation of the gravitational flow of inertial-electromagnetic space towards the center of a celestial body. The radial **acceleration** of the flow at any height outside the body, is $a = GM/r^2$ and the **velocity** is $v = \sqrt{2GM/r}$. This flow correctly models both the **ballistic** and **electromagnetic** effects of gravity.

Flowing Space Reproduces all GR's Successes—More Simply

- Herbert Ives, “Behavior of an Interferometer in a Gravitational Field”, J. Opt. Soc. Am., **29**, 183 (1939)
- Herbert Ives, “The Behavior of an Interferometer in a Gravitational Field. II. Application to a Planetary Orbit”, J. Opt. Soc. Am., **38**, 413 (1948)
- Robert Kirkwood, “The Physical Basis of Gravitation”, Phys. Rev., **92**, 1557 (1953)
- Robert Kirkwood, “Gravitational Field Equations”, Phys. Rev., **95**, 1051 (1954)
- Tom Martin, “General Relativity and Spatial Flows: I. Absolute Relativistic Dynamics”, <http://xxx.lanl.gov/abs/gr-qc/0006029> (2000)
- Tom Martin, “On the Motion of Free Material Test Particles in Arbitrary Spatial Flows”, <http://xxx.lanl.gov/abs/gr-qc/9807006> (2000)
- Andrew Hamilton, Jason Lisle, “The River Model of Black Holes”, Am J Phys, 76, 6, 519 (2008)

arXiv:gr-qc/0411060



The river model of black holes

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This paper presents a new way to conceptualize stationary black holes, which we call the river model. The river model is mathematically sound, yet simple enough that the basic picture can be understood by non-experts. In the river model, space itself flows like a river through a flat background, while objects move through the river according to the rules of special relativity. In a spherical black hole, the river of space falls into the black hole at the Newtonian escape velocity, hitting the speed of light at the horizon. Inside the horizon, the river flows inward faster than light, carrying everything with it. We show that the river model works also for rotating (Kerr-Newman)

The author acknowledges that it works for weak-gravity situations also, but finds it “discomfortingly concrete”.

Personal correspondence with A. Hamilton

Quantum Mechanics

- **Copenhagen Interpretation = Machian Subjectivism**
- Lacking any **Cosmic-physical** causes, the **observer's** act of making a **measurement** becomes the **cause!**
- The **mathematical tools** of QM are so just many **deferents, equants** and **epicycles: *ad hoc* inventions** to model the **observer's experiences** and yield the correct **predictions.**
 - Photons
 - Probability amplitudes
 - Hilbert spaces
 - Hermitian Operators
 - Fourier frequencies
 - Symmetry operations
 - Virtual particles, etc.
- As with the Ptolemaic and Relativistic systems, QM's concepts and tools **may or may not** correspond in some way to the **underlying physical reality.**
- **Subjectivistic model:** Cannot form the basis of any causal-Cosmic theory!

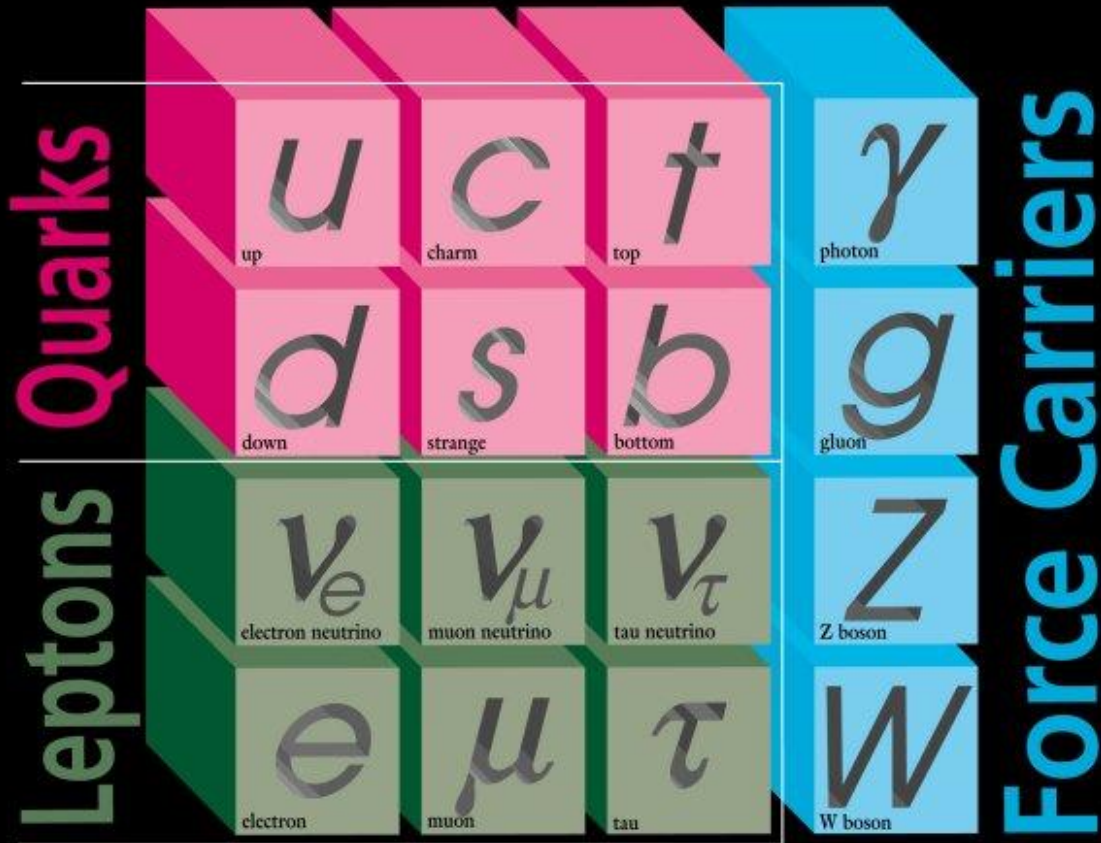
But Physicists Want Physical Theories!

- Physicists are not **subjective idealists**. They want to **explain** the Cosmos as a **physical system**, a purpose for which Relativity and QM were **not** designed!
- They must **choose** between two approaches to **physical theory**:
 - **atomism**: Space is **nothing**, a **void**. All Cosmic phenomena are produced by **self-existent particles** interacting in a **void**.
 - **etherism**: Space is a **substance** with physical qualities; as such it is the substrate of all Cosmic phenomena. Energy and particles are just different kinds of **motions and/or distortions** within **space**.

Since **etherism** was **banned**, they had to resort to **atomism**.

Standard Model

ELEMENTARY PARTICLES



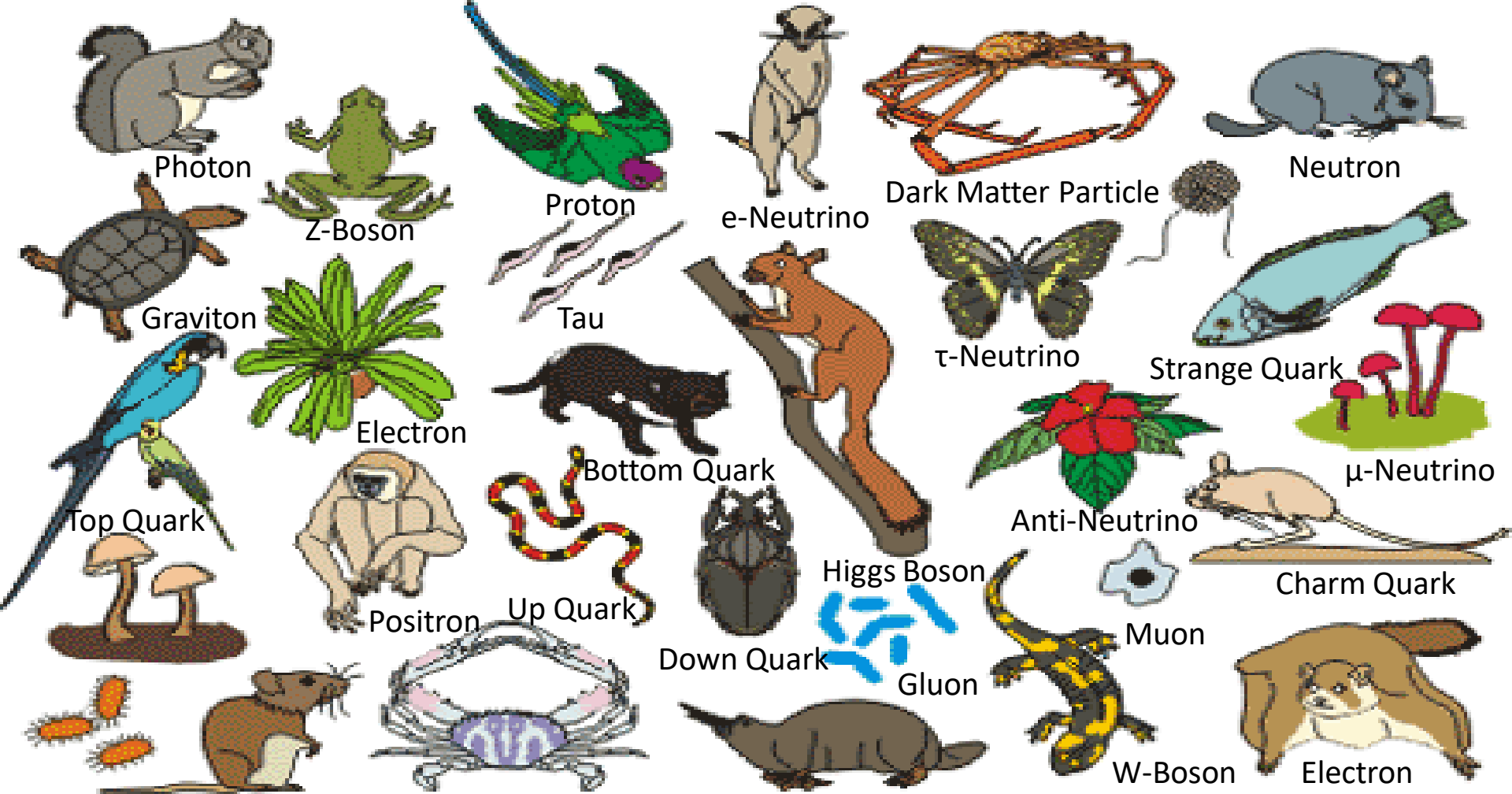
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Three Generations of Matter

Atomism: Standard Model

- **12 Particles** and **4 forces** (and “virtual” “force-carrying” particles) are **self-existent** and move in a **void**.
- **No plausible physical mechanisms**—“particle exchange” causes attraction, repulsion, inertia, gravity, etc?
- Requires **hypothetical** particles that have **never** been **observed** and make **no physical sense**—photon, gluon, graviton, Higgs boson, virtual particles, etc.
- **Contradictory**: Quantum Electrodynamics (QED) requires **wave-modeling** to predict where the **flying photon** goes! (“Wave-particle duality”)
- **Particles-in-a-void** doesn’t work, if space were a **void**:
 - Light particles could travel at **any velocity**
 - Matter’s acceleration would **not** be resisted
 - Matter could travel at **superluminal** even infinite velocities
 - **No waves** would exist, no **fields**, etc.
 - **Motion** would have **no physical** or real effect of any kind!

Atomism Needs Ether Surrogates!

- Objective Frames (inertial, Earth, Sun-Star, etc.)
- Fields—electromagnetic, gravitational
- Space (without “-time”), “curved” space-time
- Higgs Field—to give particles “mass”
- Vacuum energy
- “Negative” energy
- Strings
- Extra dimensions, “curled up” dimensions
- Membranes, “Branes”
- Quantum “foam”
- Dark Matter
- Dark Energy



Atomistic Physics is like Creationist Biology

- **Zoo** of self-existent particles.
- No **causal explanation** of the **origins** or **interactions** of particles.
- Stands in the way of all further progress in physics

Atomists Are Capitulating

- **Quantum Chromodynamics**, like QED, uses **wave-modeling** to predict where a **particle** will be **observed**.
- **Frank Wilczek** (MIT, Nobel) realizes that the facts require **space** to be a **substance**:
*“The entity we perceive as **space** is a multilayered, multicolored **superconductor** (It is) The **primary ingredient of physical reality**, from which all else is formed”*
Wilczek, F., *The Lightness of Being*, 74, 97 (2008)
- **PROBLEM:** The models he is using, **SR**, **GR**, and **QM**, were designed to **evade** the **physicality** of **space** and **prevent** us from **theorizing** about the **causes** of things!
- A theory of physical space must be based on **objectivistic models** and **physical hypotheses**.

Real Physics = Space Physics

The **Cosmos** is **space** and **motions** and **distortions** in and of **space**.

- **Replace Subjective-Idealistic** Concepts with **Cosmic-Physical** Concepts:
 - **Time** is just **Cosmic evolution**, the sequence of cause and effect
 - **Energy** is **motion** in/of **space**; it is **not** a substance.
 - **Particles** are organized, persistent **patterns** of **motion** in and of space.
- **Theorize** about the **Nature** and **Mechanisms** of **Space**:
 - **A unique, complex substance**: Beware of analogies with known substances.
 - **Quantized**: consists of the ultimate quanta (Planck scale= 10^{-33} cm?)
 - Ascribe to it **whatever qualities** are needed **to explain** the phenomena.
 - **Paradoxes (contradictions) not allowed**—must produce a better theory!