

# GOODBYE COPENHAGEN

GOODBYE TO THE COPENHAGEN QUANTUM PHYSICS OF THE LAST 100 YEARS

## Saying Goodbye to the Copenhagen Interpretation of Quantum Mechanics

by

Daniel Reed Cook, Ph.D.<sup>1</sup>

John M. Contino, M.A.<sup>2</sup>

<sup>1</sup>EyeMynd Physics Institute,  
San Francisco, California, USA

[Dan@EyeMynd.com](mailto:Dan@EyeMynd.com)

<sup>2</sup>Tricon Geophysics,  
Denver, Colorado, USA,

[John.Contino@TriconGeophysics.com](mailto:John.Contino@TriconGeophysics.com)

September 22, 2023

**Keywords:** The 1927 Copenhagen Interpretation of Quantum Mechanics, Niels Bohr, Werner Heisenberg, Erwin Schrodinger, Albert Einstein, Schrodinger's Cat of 1935, Mathematical Quantum Superposition (MQS), Physical Quantum Superposition (PQS), Elements of Physical Reality (EPR), The 1922 Stern-Gerlach Experiment, The 1895 Lorentz Force, The 1935 EPR Quantum Entanglement, The 1950 Incompleteness of the Description, The 1935 Einstein-Rosen Bridge (ER Bridge), The Initial 2013 ER=EPR Postulate, The Deeper 2016 ER Wormholes = EPR Entanglement Realization, Our Current Views of Quantum Mechanics are Provisional in 2016, Our 2023 Exact Physical ER Wormholes = Exact Physical EPR Entanglement, An Exact Deterministic Physical Interpretation of Quantum Mechanics in 2023, Our Exact Deterministic Physical Quantum Computers of 2028, Robots Running ChatGPT 8 on Our Exact Deterministic Physical Quantum Computers

## Abstract

A *deeper look* at the Lorentz force causes quantum superposition to *vanish* into thin air. Fully *understanding* this 1895 Lorentz force, will help us all finally say *Goodbye* to the *Copenhagen* Interpretation of quantum physics. This powerful Lorentz force *fully penetrates all* atomic orbitals, all atomic nuclei, and all the inner structures of all the subatomic particles. There is no need for the bewildering 96-year-old Copenhagen Interpretation, because we are now able to look *very* closely at the Lorentz force of 1895. This *Goodbye Copenhagen* article of 2023, explains how this mighty Lorentz force, completely destroys the old *Copenhagen* Interpretation of quantum mechanics. These old *Self-Contradictory* Interpretations are *no longer needed* today in 2023; because now we are finally *able to inspect* the 1895 Lorentz force *more deeply*.

## Extended Abstract

Some science historians believe that the famous 1927 Solvay Conference on Electrons and Photons [1] cemented what has come to be known as the *Copenhagen Interpretation of Quantum Mechanics*. Niels Bohr (1885-1962) and Werner Heisenberg (1901-1976) are widely regarded as two of the principal architects of what, to this day, remains the most commonly taught version of quantum mechanics on planet Earth. A defining legacy of this 96-year-old Copenhagen Interpretation is the begrudging acceptance of a stochastic, mathematical, statistical, and *probabilistic* view of quantum physics. *Until now*, none of the many alternative interpretations since 1927 have managed to conclusively *dethrone* the non-deterministic Copenhagen Interpretation. We show that Hendrik Lorentz's electromagnetic *Force Law Equation* from 1895 is a fundamental law of this physical universe that applies to *any* regular, visible-matter *particle*, no matter how *small*, that has *any* electric charge in the presence of any *electric* field or any *magnetic* field. We demonstrate how a *very careful* consideration of this fundamental *Lorentz Force*, will always illustrate how the seminal 1922 Stern-Gerlach experiment has been consistently *misinterpreted* for 101 years, to always *wrongly* conclude that this 1922 experiment somehow provided some supporting evidence for *some* combination of Initial Space Quantization, Initial Spin

Quantization, Physical Quantum Superposition, or Wavefunction Collapse. We show that the 96-year-old *Copenhagen Interpretation* of Quantum Mechanics has *No* experimental laboratory *support* from the 1922 Stern-Gerlach experiment. We also provide a logical set of compelling reasons why a *deeper look* at the *physical* Lorentz Force, clearly *demonstrates* that Physical Quantum Superposition *cannot exist* anywhere in our physical universe of galaxies, stars, planets, people, particles, atoms, electrons, and quarks.

## Introduction

Responding to the apparent need for a single mathematical equation to describe how quantum particle waves evolve in time, and move from place to place, in 1926 Erwin Schrödinger (1887-1961) postulated and published [2] his famous quantum wave equation that still bears his name today in 2023.

Just as Sir Isaac Newton (1642-1726) divined the force law ( $F=ma$ ) that enabled physicists to describe classical physics, Schrödinger divined a new quantum law in 1926 that enabled physicists to mathematically calculate how some useful quantum *probability waves* move about in space and time.

Despite the great importance of his 1926 wavefunction ( $\Psi$ -function) equation to the development of quantum mechanics, both Erwin Schrödinger and his dear wise friend Albert Einstein (1879-1955) were *enduring critics* of the increasingly world-popular Copenhagen Interpretation of 1927.

## 1935 Schrodinger's Cat

For example, in 1935, Schrödinger, gently prodded to action by his many enlightening discussions with Einstein, published [3] his famous paradox of a magical Schrodinger's Cat in a Quantum-Uncertainty Box, in order to illustrate some of the *many* practical, real-world problems with *physical* Quantum Superposition: a cat in an enclosed box will die if a single atom decays and causes a flask filled with poison (in the box) to shatter, thus killing the cat (Einstein's

original concept, of an exploding bomb killing the cat, was softened by Schrodinger to a feline-death by poison).

Some physicists still claim that the Copenhagen Interpretation of quantum physics implies that prior to opening the box, the bewildered cat is *both alive and dead*; but of course, opening the box in our real physical world reveals only one or the other *physical outcome*.

With this fanciful feline-illumination of the *quantum superposition paradox*, Schrödinger acknowledged -- and with his 1935 paper [3], strongly proclaimed to the whole wide world, that his own complex-valued  **$\Psi$ -function** (Schrodinger's Wave Function) always represented an *incomplete* description of *physical reality*.

In December 1950, towards the end of his productive life, Albert Einstein wrote an important letter [4] to his dear friend Erwin Schrödinger, once again referring to Schrödinger's 1935 Cat. In this revealing letter, Einstein reinforced his personal longstanding scientific conviction regarding the *incompleteness* of the 1926 Schrodinger Wave Function's *description* of *reality*:

*They [their scientific contemporaries] somehow believe that the quantum theory provides a description of reality, and even a **complete description**; this interpretation is, however, refuted, most elegantly by your... [cat in a box], in which the  **$\Psi$ -function** of the system contains the cat both alive and blown to bits. Is the state of the cat to be created only when a physicist investigates the situation at some definite time? Nobody really doubts that the presence or absence of the cat is something independent of the act of observation. But then the description by means of the  $\Psi$ -function is **currently incomplete**, and there must be **a more complete description**...it seems certain to me that the fundamentally statistical character of the theory is simply a consequence of **the incompleteness of the description**...[I]t is rather rough to see that we are still in the stage of our swaddling clothes, and it is not surprising that the fellows [their scientific contemporaries] **struggle against admitting it** (even to themselves).*

## The Quantum Superposition Paradox

How can a *physical* biological *cat* (Schrodinger's 1935 Cat) be *both* alive and dead (in a mystical *physical* quantum superposition of a *cat-alive* quantum state and a *cat-dead* quantum state) until the quantum scientist observes, or “measures”, the state of the cat by opening the box?

How can we all visualize a cat that is both *physically-dead* and *physically-alive* at the very same time?

To the *untrained layman*, physical quantum superposition is not merely problematic, but ***absurd***.

This quantum superposition paradox has served to wrap the Copenhagen Interpretation in a 96-year-old *shroud of mystery*, such that a Ph.D. in quantum particle physics would *seem* to be a prerequisite for its comprehension.

## Mathematical Quantum Superposition (MQS)

Every good mathematician knows that the entire body of linear differential equations logically supports *Mathematical Quantum Superposition* (MQS) as a powerful, useful, and universally acknowledged mathematical fact. This is irrefutable. This is mathematics. This *mathematics* is a very different thing than *physics*.

## Physical Quantum Superposition (PQS)

However, there may yet exist some wise physical scientists who are able to understand that *Physical Quantum Superposition* (PQS) is an entirely different matter: it appears to be unreal and unproven – existing only in the bewildered minds of those who still firmly believe in this self-contradictory component of the antiquated Copenhagen Interpretation of Quantum Mechanics. It is exceedingly difficult, and likely impossible, to defend this misguided concept of *PQS* in any logical, or scientific manner.

## MQS & PQS

By mistakenly accepting a version of physical reality that is fundamentally statistical, probabilistic, and indeterministic, many people have been lured into wrongly conflating *MQS* with *PQS*.

*PQS* and *MQS* are two entirely different things.

*MQS* is a logical *fact* of pure mathematics.

*PQS* may likely be a physical *impossibility*.

## Unstable Qubits

One of the consequences of this unfortunate misunderstanding is the begrudging acceptance of *unstable* qubits (quantum bits) as an inevitable fact of life. Despite intense, well-funded efforts by corporate and academic institutions throughout the world to fully-stabilize physical qubits, the progress so far has been lethargic at best.

## The 1922 Stern Gerlach Experiment

This *roots* of this *unstable conflation* of *MQS* with *PQS* can apparently be traced all the way back to 1922, when Otto Stern (1888-1969) and Walther Gerlach (1889-1979) published [5] their brief, *four-page* paper entitled *Experimental Evidence for Space Quantization in a Magnetic Field*. As often as this important German-language paper has been referred to during the 100-year period from 1922 to 2022, it is quite *surprising* that it was never translated into English until January 26, 2023, when Martin Bauer, from the University of Durham, U.K. Dept. of Physics, wisely did so. [6]

## Space Quantization and Spin Quantization

Their 1922 concept of “*Space Quantization*” has come to be sometimes referred to as “*Spin Quantization*”; and these quantum concepts are sometimes associated with the notion of “*Quantum Superposition*” of multiple different spins, or multiple different spatial locations.

In their startling first paragraph, Stern and Gerlach *mistakenly* claim, very boldly, that their magnetic experiments proved the existence of space quantization in a magnetic field: “[W]e allow ourselves to report in the following that the continuation of these investigations has led to establish **space quantization** in a magnetic field as a **fact**.”

Why did Otto Stern and Walther Gerlach claim in 1922 that they had established **Space Quantization** as a **Fact**? Why would these two fine, seemingly rational scientists choose to make such a rash statement?

### This Persistent Misunderstanding of 1922 to 2023

Unfortunately, this *Persistent Space Quantization Misunderstanding* has endured for *over a century* in the minds and hearts of many bright physicists from 1922 until today in 2023.

For example, Martin Bauer, in the introduction to his 2023 translation [6], bravely credits the 1922 Stern-Gerlach paper with reporting “***the first evidence for the quantization of atoms in a magnetic field. The atoms have quantum states corresponding to a limited number of possible angles between the directions of the angular momenta of the atoms and the magnetic field, also called space quantization.***”

We are *very grateful* for Martin Bauer’s January 26, 2023 *translation* into English, and for how it demonstrates to a much wider audience the *historical origin* of this **Space Quantization Misunderstanding** that is, to this day in 2023, still broadly accepted by many bright scientists throughout the world.

## Our Old Space Quantization Misunderstanding

What is the original *intellectual* source of this 101-year-old space quantization misunderstanding?

The *intellectual origins* of this *widespread* space quantization misunderstanding may possibly be found in the 1998 MIT Press paper by Bretislav Friedrich and Dudley Herschbach entitled “*Space Quantization: Otto Stern’s Lucky Star*”. [7]

On page 177 Friedrich and Herschbach write:

*Consequently, the atomic magnets **that are tilted** towards the field direction are attracted to the stronger field region, whereas those tilted away are repelled.*

*The trajectories of atoms emerging from the deflecting magnet, as recorded by deposits on the glass plate, thus **reveal the spatial orientation of the atomic magnets.***

*With such a setup, Stern predicted that space quantization would produce a splitting of the atomic beam into two distinct components, since in the ground state of the silver atom the valence electron was expected to have just one unit of orbital angular momentum ( $n = k = 1$ , so  $m = +1$  and  $-1$  components).*

***For any classical model**, however, the atomic magnets would be distributed over a continuous angular range, so passing through the deflecting field would not split the beam **but only broaden it** along the field direction.*

The words “*that are tilted*” almost seem to indicate a potential reference to the tilt (magnetic dipole orientation) of the tiny silver atomic magnets *prior* to the time the tiny silver magnets (tiny silver atoms) *initially* entered the Stern-Gerlach magnet in 1922.

This prompts the present authors to logically consider, and greatly wonder, about the potential difference between the *Initial Space Quantization* and the *Final Space Quantization* of the neutral silver atoms.



For example, what is the real difference between the *unobserved*, theoretical, mentally-imagined ***Initial Space Quantization***, and the obvious-for-all-to-see, *observed*, physically-recorded ***Final Space Quantization*** of the set of individual magnetic dipole moments, of the individual neutral silver atoms of 1922?

### **Initial Space Quantization**

What is the ***Initial Space Quantization*** (and the ***Initial Spin Quantization***, and the ***Initial Magnetic-Dipole Direction Quantization***) of the neutral silver atoms *initially, before* these neutral silver atoms even come *anywhere close* to the strong magnetic influence of the strong powerful Stern-Gerlach magnet?

### **Final Space Quantization**

What is the ***Final Space Quantization*** (and the ***Final Spin Quantization***, and the ***Final Magnetic-Dipole Direction Quantization***) of the neutral silver atoms, *after* they have *completed passing through* the strong magnetic influence of the powerful Stern-Gerlach magnet?

Is there at least a *theoretical possibility* that Final Space Quantization might be *entirely different* from Initial Space Quantization?

Can we the thinking people of Earth muster enough intellectual curiosity to *deeply consider* this potential theoretical *difference*, in a bold new effort to achieve a more complete understanding of the century-old Copenhagen Interpretation of Quantum Mechanics?

## Can we really Reveal the Spatial Orientation?

What about the words on page 177 that say: “*reveal the spatial orientation of the atomic magnets*”?

Are these revealing words referring to the *spatial orientation* of the silver atomic magnets *initially* or *finally*?

Which is it?

Is it possible that Otto Stern and Walther Gerlach actually *believed in 1922* that their overwhelmingly powerful *Thousand-Gauss Stern-Gerlach Magnet* did nothing but “*reveal*” the *initial* magnetic dipole orientations that already existed *before* the neutral silver atoms came anywhere near their powerful *torquing Stern-Gerlach Magnet*?

*How* can a big, strong, torquing magnet *not* torque a tiny little magnet, causing the tiny little magnet to *change its spatial orientation* (direction in space) of its tiny little magnetic *dipole* moment?

## Can Small Magnets Reorient Themselves?

It is well-known that many different types of magnets will often tend to *reorient themselves* to become mostly *mutually attractive*, as they are slowly brought ever closer and closer together.

Often a smaller magnet will quickly *reorient* itself, to become *mostly attracted* to either the north pole (or the south pole), of a larger more-powerful magnet.

## Financial Pressure & Scientific Peer Pressure

What kind of *financial pressure* and intense *scientific peer pressure* in 1922 was put on the vulnerable minds and hearts of Otto Stern and Walter Gerlach, causing them both to *seemingly-forget* how tiny little magnets (like their tiny little neutral silver-atom magnets) *reorient themselves* in the presence of a large, overwhelmingly-powerful *torquing magnet*, like their 1,000 Gauss Stern-Gerlach Magnet of 1922?

What kind of intense *financial pressures* and absurd *scientific peer pressures*, even in this seemingly-modern day of 2023, are still being constantly *forced* into the vulnerable *minds*, and tender human *hearts*, of thousands of good young *scientists* working diligently in their dozens of quantum computing *laboratories* worldwide, causing so many of them to *seemingly-forget* how tiny little atomic (and ionic, and molecular, and electronic) magnets *reorient themselves* every microsecond, of every hour, of every day, in the presence of *their* strong, overpowering *magnets*, that are *just like* the strong, *torquing*, overpowering Stern-Gerlach-Like *magnets* that are *still in use* in the *dozens* of quantum computing laboratories of *today* in 2023?

### What are Classical Magnet Models?

And what about the page 177 words that say: “*For any classical model ... but only broaden it*”?

Did Otto Stern and Walther Gerlach sincerely believe in 1922 that a *small classical magnet* (like a tiny bar magnet, or a tiny compass needle) would not quickly become *dynamically compelled* by a combination of *magnetic torques* and *magnetic forces*, to simply *reorient itself* to become mostly *attracted* to either the north pole, or the south pole, of a big strong *torquing* magnet; and in this way become strongly *deflected* towards either the strong north pole, or the strong south pole, but *not* towards the middle region that is exactly between these two strong magnetic poles?

By *splitting themselves* into *two separate beams*, did not the tiny neutral silver atom magnets behave *exactly* like we would logically expect most any other set of *tiny classical magnets* to classically behave while passing through a powerful *torquing* magnet, like the massive Stern-Gerlach magnet of 1922?

## Tiny Silver Classical Magnets

How did these *tiny silver atom magnets* behave any differently from *tiny classical magnets* in 1922?

What is the real physical scientific distinction between “*classical*” and “*quantum*”, if any, in the context of this 1922 experiment, or in the context of any other laboratory experiment conducted anywhere on Earth since then?

Has anyone anywhere ever been able to *logically* explain this *hypothetical distinction*?

## No Wavefunction Collapse

How can we (the scientists of Earth) possibly claim that their “*wavefunction has collapsed*” upon passing through the Stern-Gerlach magnet, when all these tiny silver atoms are behaving *properly*, and magnetically, just *exactly* like *tiny classical magnets* always behave?

Each and every tiny classical magnet will always behave magnetically, according to the *understandable laws* of classical magnetic mechanics.

*Classical Mechanics* is *Understandable Mechanics*, and as such they are therefore *equivalent, or identical*, to each other.

There is a *deep connection* between Classical Mechanics and Quantum Mechanics, because at its exact physical core, *Quantum Mechanics* becomes *Understandable as well*.

## No Quantum Superposition

How can we (the physicists of Earth) presume to be so bold as to wildly claim that every individual tiny silver atom is *already* either *spin-up* or *spin-down* (or in a physical *quantum superposition* of *spin-up* and *spin-down*) before the physical tiny silver atom even comes anywhere near the large, powerful, torquing Stern-Gerlach magnet?

## **No Scientific Basis for the Copenhagen Interpretation**

Are you now beginning to suspect, after just reading a few initial pages of this *Goodbye Copenhagen* article, that there may actually be *zero logical basis* for invoking any of the *self-contradictory concepts* of the Copenhagen Interpretation of Quantum Mechanics?

Upon a *closer physical inspection*, all false pretenses may simply vanish into *thin air*.

What is the *Lofty* Copenhagen Interpretation actually composed of *physically*?

Why is it *so unstable*, and what exactly is contained inside the *self-contradictory* structure of its *faulty foundation*?

## **An Unstable House of Cards**

This tired, 96-year-old Copenhagen Interpretation of Quantum Mechanics is an *unstable house* of thin *flimsy cards*, that must physically collapse just as soon as we become able to look *closely and deeply* at the 1922 Stern-Gerlach *Magnetic Experiment*, with its tiny *magnetic* silver atoms, and its powerful magnetic *Lorentz* force.

Is this yet *obvious* to you, our thinking reader?

It will be, after we all take the time to *look close enough*, at the famous 1922 Stern-Gerlach Experiment.

## **Many Tiny Magnets with One Big Strong Magnet**

In their famous 1922 experiment, Otto Stern and Walther Gerlach passed a beam of *neutral silver atoms* through a narrow slit and along a sharp *magnetic* knife edge. The beam of tiny silver atoms (which are *tiny silver magnets*) were experimentally observed to be “*split*” by the strong *magnetic field* (of their relatively-large *powerful magnet*) by observing the silver imprint of thousands of these magnetic silver atoms onto a photographic plate.

The photos revealed the tiny *silver magnets* (tiny magnetic neutral silver atoms) to be roughly equally repelled, or attracted, by the big strong *north pole* (and the big strong *south pole*) of the powerful non-homogeneous *magnetic field*.

### **Stern-Gerlach's Wild Assumption of 1922**

*Astonishingly*, according to their brief assuming paper, Stern-Gerlach's underlying ***Initial Space Quantization Assumption*** of 1922, seems to be that each and every individual neutral silver atom magnetic *dipole* moment was ***already initially*** magnetically *pointing* either *exactly up*, or *exactly down*, (and in *exactly zero* of the other millions of possible magnetic-dipole directions) ***prior*** to passing through the big powerful inhomogeneous Stern-Gerlach Magnet. For over 100 years, this ***Absurd Initial Space Quantization Presumption*** continues to lie at the very root of the *mistaken interpretation* of the experiment's outcome, and thereby at the very **Root** of ***our worldwide collective misunderstanding*** of the Copenhagen Interpretation of Quantum Mechanics.

The *good news* is that there now exists a simpler, more accurate and logical *physical explanation* that is easy to understand, and it is *scientifically described* in this very paper.

### **A Large Powerful Horseshoe Magnet**

Suppose, for example, that one large, powerful inhomogeneous *horseshoe magnet* is slowly and carefully lowered down towards a smooth, flat, wooden table upon which thousands of tiny magnets (like tiny bar magnets, or tiny compass needles) are already distributed randomly across the tabletop.

The original *positions* (and original *orientations*) of the thousands of tiny magnets, relative to the one location (and the one orientation) of the two strong magnetic poles (north and south) of the one large powerful horseshoe magnet, will *largely determine* how the thousands of tiny magnets behave, as the one large magnet continues to be slowly lowered down toward them all.

As the north pole (and the south pole) of the one large powerful horseshoe magnet gets closer and closer to the thousands of tiny magnets, each one, of the individual tiny magnets, will begin to feel a magnetic *north-torque* induced by the strong horseshoe north pole, and a magnetic *south-torque* induced by the strong horseshoe south pole.

#### 4 Directions & 4 Magnitudes

Each of these *two competing* magnetic *torques* will try to twist each tiny magnet, to align itself, with one of the two big, strong, powerful horseshoe magnet poles.

Each one of the individual tiny magnets will also begin to feel a magnetic *north-force* pulling the tiny magnet towards the strong horseshoe north pole, and a magnetic *south-force* pulling the tiny magnet towards the strong horseshoe south pole.

Each of these *two competing* magnetic *forces* will try to push and pull each tiny magnet, to move itself towards one of the two big, strong, powerful horseshoe magnet poles.

Eventually, the tiny magnets will *change* their magnetic *dipole orientations* as they fly upwards into the air, as they are strongly attracted to the powerful horseshoe magnetic field that *reorients* (via north pole and south pole magnetic *torques*) and *gathers* (via *inhomogeneous* magnetic-gradient *net attraction*) all the tiny magnets, as they fly upwards into the air and firmly attach themselves to either the north pole, or the south pole, of the large powerful horseshoe magnet.

As each little, tiny magnet slightly changes its orientation, the two torques and the two forces *dynamically change* their *four directions* and their *four magnitudes* as these tiny little magnets fly upwards into the air, and fly towards the horseshoe magnetic pole that *eventually* attracts them the *most strongly*, and the *most successfully*.

## The Most Important Thing to Notice

*Most importantly*, there is **Nothing** mysterious, mystical, or probabilistic about the *dynamic magnetic behaviors* of these thousands of tiny magnets.

Their tiny magnetic dipole orientation, the classical physics of magnetic forces and magnetic torques, and how these classical *understandable* torques, and classical *understandable* forces, dynamically alter the particle motion of the tiny magnets. These powerful *dynamic forces* work together to classically determine – *exactly* and causally – how these tiny magnets *physically* behave.

In every case, a particular set of stronger magnetic forces, and stronger magnetic torques, *deterministically overpowers* the weaker forces, and the weaker torques, *deterministically causing* each tiny magnet eventually to dynamically *reorient* itself to become *mostly attracted* to either the north pole or south pole of the big strong horseshoe magnet.

As for the thousands of neutral **silver-atom tiny magnets** in the Stern-Gerlach magnet experiment, their final position (their Final Space Quantization) on the silver-collecting photographic plate of the magnetic experiment, depends upon their original orientation and their original position, as they initiated their movements towards the powerful, *inhomogeneous*, strong magnetic-spatial-gradient Stern-Gerlach magnet of 1922.

As these thousands of neutral silver-atom tiny magnets travel between the two strong magnetic poles of the large powerful Stern-Gerlach magnet, each one of these individual tiny silver-atom magnets will magnetically experience a dynamic interaction of **two** magnetic *forces* and **two** magnetic *torques*, which will cause these tiny silver-atom magnets to experience a **deterministic classical change** in their position as they eventually become pulled *mostly towards* either the north pole, or the south pole, as these thousands of neutral silver-atom tiny magnets travel through the *entire length* of the *3.5-centimeter-long* Stern-Gerlach magnet, and eventually deposit themselves on the final recording, silver-collecting, film plate, where they finally report their *final positions* (their *Final Space Quantization* positions) with their individual atomic silver *deposit locations* on the recording film plate.



There is *Nothing* mystical, mysterious, *absurd*, or statistical about what happens to one single individual neutral silver atom, as it passes through the powerful torquing Stern-Gerlach magnet.

### **No Logical Scientific Need for Quantum Superposition**

There is certainly *No logical scientific justification* to ever assert any type of *Initial Space Quantization*, initial spin quantization, initial dipole direction quantization, or *Initial Physical Quantum Superposition* (Initial PQS) of the initial silver-atom spins, and their associated initial silver-atom magnetic dipole moments.

This is the *most important concept to discern* regarding the 1922 Stern-Gerlach Magnetic Experiment.

The 1922 Stern-Gerlach Magnetic Experiment *did not* demonstrate any type of Initial Space Quantization, *nor* any type of Initial Physical Quantum Superposition, *nor* any type of Wavefunction Collapse of Schrodinger's *Ψ-function* Wavefunction.

### **What did Stern-Gerlach Really Show?**

*What* did the Stern-Gerlach Experiment of 1922 demonstrate *conclusively*?

This is a *very important question* for all us logical thinkers of Earth.

The *future* of quantum physics will *certainly* depend upon us answering this vital question *correctly* and *completely*.

It certainly seems logical, and likely, that the 1922 Stern-Gerlach Experiment *did not* demonstrate *any* type of *initial* space quantization.

The 1922 Stern-Gerlach Experiment *did*, however, apparently demonstrate that neutral silver atoms are *tiny magnets* that *behave classically* – no differently from many other types of deterministic tiny magnets (like tiny compass needles) that observe the simple and easily understandable laws of classical physics relating to  $F=ma$ .

We, the thinking people of planet Earth, by pondering carefully, deeply, and logically, can choose to acknowledge the ***intelligent scientific realization*** that it appears obvious that this 1922 Stern-Gerlach Experiment successfully demonstrated that a neutral silver atom will tend to behave much like a *small classical magnet* as it passes through a large powerful magnet.

This important ***scientific realization*** may now be able to *guide us all* towards a good number of useful ***new scientific discoveries*** in the areas of *quantum physics* and *quantum computation*.

Can this new, powerful scientific realization somehow help us discover a good scientific way forward to ***upgrade*** quantum mechanics – that is, to wisely transform it into a *more complete theory* of physics?

Why is good *clear logical thinking* so vitally important in this physical science endeavor?

### **Good Logical Thinkers**

With some modest effort, every one of *us good logical thinkers* can develop a decent appreciation for how a tiny magnet (like a tiny bar magnet, or a tiny compass needle magnet, or a tiny neutral silver-atom magnet) physically responds to a much larger and more powerful magnet, like any big horseshoe magnet, or like Stern-Gerlach's powerful magnet of 1922.

In hindsight, Otto Stern and Walther Gerlach had ***No good logical reason*** to wildly claim "*space quantization*" in their famous 1922 publication.

These two bright and talented experimentalists may have had the intellectual ability to think logically about how tiny magnets physically respond to large strong magnets.

However, it's possible that their otherwise bright logical thinking *abilities* were *disrupted* by *excessive academic pressure*. [8]

## Excessive Academic Pressure

Have any of us, as students, ever experienced *Excessive Academic Pressure* to think or act a particular way, or perhaps to publish a specific preordained conclusion?

As mortal human beings, can we not sometimes become emotionally *vulnerable* to excessive peer pressure? Have we ever experienced so much pressure that we can *no longer* think straight?

What sort of peer pressure can cause us all to abandon our own individual and valid logic, in favor of the ingrained, irrational bewilderment of *group think*?

Why has the *intellectually-absurd* 96-year-old *Copenhagen Interpretation* persisted here on this Earth planet for so many years?

Who among us can *finally understand*, and be willing to *publicly admit*, that we do in fact have the intellectual ability to scientifically understand how a tiny little magnet can physically respond to a big strong magnet?

Who among us is willing, and able, to take some of our precious time to *carefully*, and logically, *reinterpret* the old Stern-Gerlach result of 1922 along purely scientific lines of *clear rational thought*?

And who among us, even today in 2023, is still feeling the intense *intellectual peer pressure* of the dominant, *group-think* Copenhagen Interpretation of Quantum Physics?

Who among us is *willing* to stand up and question Copenhagen deeply enough, to finally say *Goodbye* to it, and to *All* of its absurd intellectual nonsense?

There is *one brave*, independent thinker who, perhaps more than any other, was willing to publicly stand up and *publicly question* all the Copenhagen nonsense again and again and again, during the last three decades of his productive life.

His name was *Albert Einstein*.

## 1935 EPR Entanglement

Albert Einstein's May 15, 1935 paper [9], entitled *Can Quantum Mechanical Description of Physical Reality Be Considered Complete?* became, and remains to this day in 2023, one of the most famous papers ever published by *Physical Review*. This seminal paper was co-authored by Albert Einstein with his two bright, clear-thinking, post-doctoral assistants, Boris Podolsky and Nathan Rosen.

This marvelous 1935 paper is commonly referred to as *EPR*, after the last names of its three authors. This wonderful paper has also come to be seen by many of us logical, rational thinkers as a worldwide scientific wake-up call to respect and recognize *all* of the important *Elements of Physical Reality* (EPR).

This 1935 EPR paper wisely *presaged* the many fascinating experiments wherein *two quantum systems* (like two quantum particles) interact with each other, such that some of their *physical properties* (such as their positions, momenta, and spins) become *quantum-linked* (connected, bonded, correlated) and this *quantum-linkage continues* across *great distances*, even when the two quantum particles (or the two quantum systems) later become *widely separated* in space.

If the position or momentum of a first system (first particle) is determined via measurement (observation), then the respective position or momentum of the second system (second particle) somehow also becomes determined, due to its “*quantum entanglement*” with the first system (first particle).

### The Elements of Physical Reality (EPR)

Apparently, Erwin Schrodinger coined the term “*quantum entanglement*” to characterize this phenomenon, because the two particles (two quantum systems) can sometimes *behave together* like they are *entangled* (entanglement-bonded) with each other, kind of like the two spin-opposing electrons of a single molecular covalent bond, even when the *two particles* (two quantum systems, like two electrons, or two other quantum particles) are widely separated from each other, in our universe, by a vast *spacelike* distance.

Unfortunately, an overly rigid, *dogmatic* adherence to the 96-year-old Copenhagen Interpretation may have led some well-intentioned scientists to misunderstand these important *Elements of Physical Reality* (EPR).

Relatively recently, a few other *clear-thinking* scientists have finally started to arrive at the logical scientific realization that it is now academically okay, and even rationally desirable, to seek for the *physical bridge mechanisms* that are physically responsible for creating and maintaining this ultrafast *physical EPR* quantum entanglement *link* that physically *bridges* two quantum systems together across the vast *space-like* distances of this vast physical universe where we all live.

### **Does ER=EPR?**

Two of these *forward-thinking* scientists, Juan Maldacena and Leonard Susskind, published a paper [10] in 2013 entitled *Cool horizons for entangled black holes*. These authors refer to general relativity solutions which allow for the interior of two distant black holes to be connected by an Einstein-Rosen bridge (*ER*), or *ER* wormhole:

*“These [general relativity] solutions can be interpreted as maximally **entangled states** of two black holes that form a complex **EPR pair**. We suggest that **similar bridges** might be present for **more general entangled states**.”*

These two wise authors describe similarities between entanglement (*EPR*) and *ER bridges*, and varying degrees of entanglement. They conclude, in a word, that the *ER bridge* is a manifestation of *entanglement*, and that the *ER=EPR connection* applies more generally than just to black holes.

### **Copenhagen is just a Provisional Theory in 2016**

Just 3 years later, in April, 2016, Leonard Susskind published *Copenhagen vs Everett, Teleportation, and ER=EPR* [11]. In his insightful paper he discusses how, until recently, his opinion of quantum mechanics had coincided with those of renowned physicists such as Richard Feynman and Paul Dirac, namely:

*“Quantum mechanics is so **confusing** that I can’t even tell if there is a problem, but maybe it’s all ok because it works.*

*There is probably not much profit in thinking about ‘**interpretations**’ and even less in arguing about them.”*

The wise, learning Leonard Susskind then further elaborates on how his personal scientific views have changed:

*But over the last two years I’ve come to **see it differently**.*

*Now I feel that our **current views** of quantum mechanics are **provisional**;*

*it’s the best we can do without a much **deeper** understanding of its connection with **gravity**,*

*but it’s **not final**.*

*The reason involves a very particular development,*

*the so-called **ER=EPR** principle.*

***ER=EPR** tells us that the immensely complicated **network** of **entangled subsystems** that comprises the universe is **also** an immensely complicated (and technically complex) **network** of **Einstein-Rosen bridges**.*

*To me it **seems obvious** that if **ER=EPR** is true it is a **very big deal**, and it must affect the **foundations** and **interpretation** of **quantum mechanics**.*

What also *seems obvious* to the present authors, is that every passing year, more and more scientists are finally **questioning** the 96-year-old Copenhagen Interpretation – an interpretation that *unfortunately* still serves as the **financial foundation** upon which billions of dollars are already being spent by corporations struggling to achieve the **stable qubits** that are required for the **quantum computers** of the future.

## An ER=EPR Physical Bridge

If Leonard Susskind and Albert Einstein are both correct in that a more comprehensive *ER=EPR physical-bridge* description of quantum physics is really *necessary*, then a lot of time and money is being *wasted*, every day, trying to build quantum computers upon a *shaky* sand-shifting *foundation* – one that is not based on an *exact, deterministic*, and most importantly a *physical* interpretation of quantum physics.

We can all greatly wonder about what really happened to quantum physics many decades ago.

What happened to the *initial* ideas in the early days of quantum physics, over a hundred years ago, that put quantum physics on such a *shaky, provisional foundation* of incredible intellectual bewilderment?

What *shook* this early intellectual world in 1913?

## Niels Bohr (1885-1962)

What exactly happened with the bold, brilliant, young *Danish* physicist from *Copenhagen* named *Niels Bohr* (1885-1962), who received his Nobel Prize in Physics in 1922; the very same year of the famous Stern-Gerlach Experiment with tiny silver magnets?

What happened to the decisive, brilliant, yet *still-vulnerable*, mortal-human brain of the newly married Niels Bohr in 1912 and 1913, just prior to the vicious outbreak of World War I?

What really happened with the bright young Niels Henrik David Bohr, *before any of us* were even born into this war-torn world of ours?

## Niels Bohr & Ernest Rutherford

The young Niels Bohr greatly admired his mentor, Ernest Rutherford (1871-1937), who was a brilliant exploratory pioneer of experimental physics, especially regarding radioactivity and nuclear physics.

In 1911 Ernest Rutherford envisioned *atoms* as miniature solar systems, with electrons *orbiting* around a central tiny heavy nucleus, almost like planets orbiting around our sun.

The younger Niels Bohr (1885-1962) was heavily influenced by Ernest Rutherford, and together they productively worked on some new theoretical models for the hydrogen atom.

Apparently, Niels Bohr became inspired in 1912 by learning about the surprisingly-accurate *1885 Balmer formula* for some visible spectral lines of the hydrogen atom, which was published the very same year that little baby Bohr was born.

## Johann Jakob Balmer (1825-1898)

Johann Jakob Balmer (1825-1898) was a 19<sup>th</sup> century Swiss mathematics teacher who believed that some manner of “*unified harmony*” governed the world, and he became obsessed with discovering how these *harmonic relations* could be expressed *mathematically*.

In 1885, when he was *sixty*, Balmer used the *frequencies* of the first *four* bright visible spectral lines of *hydrogen* that had already been measured by *Anders Angstrom*, and derived an amazingly simple formula of *integers*, which accurately calculates some of the spectral frequency line emissions of the hydrogen atom.

Although Balmer’s formula worked surprisingly well for the visible Balmer Series of the *Hydrogen atom*, it seemed like no one could explain *How* (or *Why*) it worked so well – that is, until it was shown to Niels Bohr in 1912, for whom the formula became an *exciting revelation*.



## **Johannes Rydberg (1854-1919)**

By 1888, Swedish physicist Johannes Rydberg (1854-1919), had devised a more *generalized* formula to calculate the *wavelengths* of *any* of the frequency lines of the Hydrogen atom emission spectrum.

The *Rydberg Constant* emerged as a physical constant that fit Rydberg's formula based on empirical results for the hydrogen spectral series.

In 1913, Niels Bohr, using *Planck's Constant* (and the constants for *electron mass* and *electron charge*) was able to *theoretically* calculate *Rydberg's Constant*, which Rydberg had derived empirically from *experimental* data in 1888.

This was certainly a major discovery of *theoretical physics* for Niels Bohr, and for *all of us* precious humans of Earth, in 1913.

## **The Physical Bohr Atom of 1913**

The brilliant, bold, young Niels Bohr also successfully managed to *accurately predict* new line spectra for hydrogen at different wavelengths beyond the visible spectrum. It was to this *astonishing degree* that Bohr's theoretical calculations matched Rydberg's empirically derived constant, that *forced physicists* to take ***Bohr's 1913 model*** of the Hydrogen atom seriously.

### **“On the Constitution of Atoms and Molecules”**

Is the famous title of Niels Bohr's most *famous* paper [12] of 1913.

Niels Bohr *wisely postulated* that physical negative electrons *orbiting* a tiny heavy positive physical nucleus inhabit *atomic orbits* with a set of discreet (*quantum*) energy states.

Max Planck's concept of the quantization of energy helped Albert Einstein postulate the existence of *photons*, whose energy is simply *proportional* to their frequency.

These early *quantum photon* concepts helped Bohr to conclude that, contrary to the prevailing wisdom, orbiting electrons *do not* constantly emit radiation, but rather emit or absorb a *single photon* as they move to a higher, or to a lower, electron energy state, or electron *orbital*.

Neil Bohr's 1913 paper went a long way towards describing some of the essential *physical characteristics* of the atomic *structure* of the physical Hydrogen *atom*.

In his brilliant 1913 Bohr atomic model, the *energy* of an atom is ***physically restricted*** to a set of *unique* discrete "*quantum*" values.

Niels Bohr was also able to apply his new 1913 atomic theory to the *periodic table* of the *elements*, by showing that the *chemical properties* of an element are derived from the electrons occupying the highest stable orbit where these *outer valence electrons* travel around the *outer regions* of an atom. He *predicted* that the unknown element #72 would resemble zirconium, and he was proved *correct* with the discovery of Hafnium in 1923.

### **The Heisenberg Uncertainty Principle**

It may have been said by some that Bohr's 1913 atomic model is *incompatible* with *Heisenberg's Uncertainty Principle*.

It can be *intellectually* argued, however, that this may *soon* turn out to be more of a *compliment* than a criticism of Bohr's 1913 model of the atom.

It can be further argued that in the few years after 1913, Niels Bohr may have allowed himself to gradually get *intellectually sidetracked*, when he started to fall under the *group hypnotic trance* of the ***Copenhagen Interpretation*** for the ***Mathematical Probabilistic Quantum Mechanical Constitution of Atoms and Molecules***, that seems to almost *claim* that atoms and molecules *do not have* definite physical properties prior to being measured.

*Unfortunately*, Niels Bohr may have spent his final decades delving ever deeper and deeper into the *intellectual bewilderment* of the Copenhagen Interpretation of Quantum Mechanics.

## Intellectual Copenhagen Bewilderment

However, Niels Bohr is not the only talented physicist to have gone down this *dark* and *dreary path* of intellectual Copenhagen bewilderment.

Werner Heisenberg, Max Born, and *many* others, eagerly followed Niels Bohr down into the *dark intellectual pit* of Copenhagen bewilderment for many years.

Haven't *we all* to some extent?

Who among us wise logical thinkers of Earth have not *been tempted* to *try* to somehow *make some sense* of the Copenhagen Interpretation of Quantum Mechanics in our tired bewildered minds?

The *main problem* with the Copenhagen Interpretation of Quantum Mechanics is that it is simply *incompatible* with a logical mind.

Who among us has a *logical mind* that can *always* be trusted, with good reason, no matter what?

Who had a good solid logical mind *prior* to 1922?

It seems like a good man, named Hendrik Antoon Lorentz (1853-1928), *already* had a bright, insightful, and deeply-pervasive mind, 27 years prior to 1922.

What *revealing*, accurate, simple, universal, physical *Electromagnetic Force Law*, did this brilliant Dutch physicist discover in 1895?

### Hendrik Antoon Lorentz (1853-1928)

Hendrik Antoon Lorentz derived a simple, *extremely accurate*, mathematical, and *totally correct* electromagnetic *force-law equation* in 1895 [13]. Astonishingly, it *always* works well, even for the tiny electrically charged subatomic particles moving about the *interior* of atoms.

This universal *electromagnetic force* law is today appropriately called *The Lorentz Force*.

The very interesting *magnetic part* of this **Lorentz Force** is also sometimes called the “ $\mathbf{v} \times \mathbf{B}$ ” force, which is usually pronounced in the *English language*, as the “*vee cross Bee*” force.

### The $\mathbf{v} \times \mathbf{B}$ Lorentz Force

The super-simple, most-general, fully-complete, totally-universal, electromagnetic *Lorentz Force* on a particle of charge  $q$  and velocity  $\mathbf{v}$  is

$$\mathbf{F} = q\mathbf{E} + q\mathbf{v} \times \mathbf{B}$$

with

$\mathbf{F}$  = **Force** on a particle of velocity  $\mathbf{v}$  and charge  $q$ ,

$\mathbf{E}$  = **Electric Field**,

$\mathbf{B}$  = **Magnetic Field**,

with  $\mathbf{F}$ ,  $\mathbf{E}$ ,  $\mathbf{v}$ , and  $\mathbf{B}$ , all being **vector-valued functions** of space  $\mathbf{x} = (x, y, z)$  and time  $t$ .

### The Universal Lorentz Force Law

*This Universal Lorentz Force Law* may possibly be the *most fundamental force* in this whole physical universe of galaxies, stars, planets, people, particles, molecules, atoms, electrons, and quarks.

It may never be possible to *overstate* the *Universal Importance* of this *Mighty Lorentz Force*:

$$\mathbf{F} = q\mathbf{E} + q\mathbf{v} \times \mathbf{B}$$

where in general,

$$\mathbf{F}(\mathbf{x}, t) = q\mathbf{E}(\mathbf{x}, t) + q\mathbf{v}(\mathbf{x}, t) \times \mathbf{B}(\mathbf{x}, t)$$

with

$\mathbf{v}(\mathbf{x}, t)$  = the *vector velocity*  $\mathbf{v}$  of one single individual *particle* (with charge  $q$ ) as it *moves* in three-dimensional *space*  $\mathbf{x} = (x, y, z)$  and *time*  $t$ ,

and with

$$\mathbf{F}(\mathbf{x}, t) = \mathbf{F}(x, y, z, t),$$

$$\mathbf{E}(\mathbf{x}, t) = \mathbf{E}(x, y, z, t),$$

$$\mathbf{v}(\mathbf{x}, t) = \mathbf{v}(x, y, z, t),$$

$$\mathbf{B}(\mathbf{x}, t) = \mathbf{B}(x, y, z, t),$$

because there really do exist *three* distinct spatial physical *components*  $\mathbf{x} = (x, y, z)$  of the three-dimensional *physical space* that we (us physical people of Earth) all live, all walk, and all breathe in, as a *function of time*  $t$ .

### ***An Electromagnetic Forcefield for our Spacetime***

Therefore, this Universal Lorentz Force  $\mathbf{F}(x, y, z, t)$ , is in fact an ***Electromagnetic Forcefield*** of *3D Space*  $\mathbf{x} = (x, y, z)$ , and *1D Time*  $t$ , that may be more-explicitly written as

$$\mathbf{F}(x, y, z, t) = q\mathbf{E}(x, y, z, t) + q\mathbf{v}(x, y, z, t) \times \mathbf{B}(x, y, z, t)$$

where we *explicitly show* that these 4 distinct vector fields ( $\mathbf{F}$ ,  $\mathbf{E}$ ,  $\mathbf{v}$ , and  $\mathbf{B}$ ) all *depend deeply* (with *exact physical sensitivity*) on their *exact spatial positions* in  $x$  space,  $y$  space, and in  $z$  space, and also in time  $t$ .

### The “*vee cross Bee*” ( $\mathbf{v} \times \mathbf{B}$ ) Force

The very-interesting “*vee cross Bee*” force,  $\mathbf{v} \times \mathbf{B}$ , is often written with a little *cross* symbol “ $\times$ ”, to indicate a *vector cross product*.

In this way, the little mathematical *cross* symbol “ $\times$ ” in  $\mathbf{v} \times \mathbf{B}$  simply indicates that the velocity vector  $\mathbf{v}$  is simply *crossed* into the magnetic field vector  $\mathbf{B}$ , via a mathematical outer “*cross*” product operation.

This *outer cross product* operation, is the standard mathematical “*cross product*” way, of simply *multiplying* two spatial vectors *together*, to form a *new vector*, that always *points* in a *new direction*; with this new direction always being *perpendicular* to *both*  $\mathbf{v}$  and  $\mathbf{B}$ , at *all times*  $t$ , and at *every point* in space  $\mathbf{x} = (x, y, z)$ , according to the proper “*right-hand*” rule, of the standard mathematically-defined *vector cross product* in  $\mathbf{v} \times \mathbf{B}$ .

### Our Simple Clear $\mathbf{F} = q\mathbf{E} + q\mathbf{v} \times \mathbf{B}$ Force

Therefore, a very *simple* clear way of *writing* this easy-to-understand Lorentz force is simply:

$$\mathbf{F} = q\mathbf{E} + q\mathbf{v} \times \mathbf{B}$$

This is a simple *compact* way of writing our *Universal Lorentz Force Law*; and it actually really physically means a *whole lot* in our real *physical universe* of real physics.

### A Real Force $\mathbf{F} = q\mathbf{E} + q\mathbf{v} \times \mathbf{B}$ for a Real Universe

This *Real Physical Force* controls our *Real Physical Universe*; and our real physical world of *Real Physics* is this real physical universe, where we are all currently living today here on planet Earth inside our own milky-way galaxy.

This universal real *physical force*  $\mathbf{F} = q\mathbf{E} + q\mathbf{v} \times \mathbf{B}$  of real physical *electric* fields  $\mathbf{E}$ , and real physical *magnetic* fields  $\mathbf{B}$ , and real *physical particles* of real physical velocities  $\mathbf{v}$ , and real physical *charges*  $q$ , is the real *physical source* of all of the real physical *forces*  $\mathbf{F} = \mathbf{F}(x, y, z, t)$ , that forcefully act on all the real physical

particles that have real *physical positions* in x space, and that have real physical positions in y space, and that have real physical positions in z space, and that have real *physical times* t.

### **One Force to Rule them All**

But could it really be this simple, with just *one* simple electromagnetic force to *rule them all*?

How could a theory of *real physics* be so utterly simple?

What about the *gravitational* force, the *weak* nuclear force, and the *strong* nuclear force?

How can just *One Force* Rule them *All*?

Wouldn't this nearly amount to a simple, easy to understand, logical *grand unification* of all four, of these *Four Forces* of nature?

### **Occam's Razor of Simple Understandable Theories**

Why is *Occam's Razor* such a useful guiding principle?

Who desires to discover a *Simple Understandable Theory* of Quantum Physics and the Four Forces of our physical universe?

What is the Occam's Razor way of *physically* (and mathematically) *constructing* such a simple Grand Unified Theory (*GUT*) of Everything (*ToE*)?

There are already a *huge number* of untestable academic theories that are so complex, and so sophisticated, that *no one* on Earth can understand them.

Does every sophisticated, highly-academic theory need to be *complex & difficult* to understand?

Does the academic love of *superfluous* sophistication cause any *problems* for us in our prideful lofty world?

Is this one more powerful *cause* for the bewildering academic construction, during 1922-1927, of the Copenhagen Interpretation of Quantum Physics?

### **Albert Einstein** sought for an **Understandable Theory**

Is this why Albert Einstein *hated* the Copenhagen Interpretation with *every fiber* of his scientific being?

Was Albert Einstein seeking an *understandable* theory of quantum physics?

Who among us has ever sought a *simple* physical theory of quantum physics that can be *easily* comprehended?

What happens when we the people *seek* things that we *cannot* understand?

Has *any* human on Earth *ever* searched for something that *he cannot* understand?

What did Werner Heisenberg do?

Why is *Occam's Razor* so important to *every* science?

What exactly is Occam's *Physical* Razor of Real Science?

Occam's Razor says that the *most-simple* understandable theory, that *best fits* (scientifically matches) *all* the observable *physical* measurements, will usually turn out to be the *very best* (most accurate and most complete) *theory*.

### **An Occam's Razor Force**

Does the *Lorentz Force* of  $\mathbf{F} = q\mathbf{E} + q\mathbf{v} \times \mathbf{B}$ , fully qualify as a proper *Occam's Razor Force*, to logically guide, and physically inspire our scientific quest to find *one single*, Occam-simple, easily-understandable, accurate, *complete*, useful, *stable*, and physical *quantum force*, to scientifically unify and *physically-stabilize* each and *every qubit* of quantum physics?



Does this *Real Physical Lorentz Force* really control our *Real Physical Universe*?

What is the actual *physical role*, that his mighty Occam's Razor Force, really plays in our real physical world of *Real Physics*?

### **What is Occam's Razor?**

Is the real truth about Occam's Razor simply the scientific realization that the *real science* of real physics is always to be found in its *physical simplicity*?

### **Simple Theories are Understandable Theories**

Why are the *Simple Theories* the *Understandable Theories*?

Does *Simple* mean *Understandable*?

What is the *Real Truth* about *Real Science*?

Is it Understandable?

Is it Simple?

Why not?

Is our beloved Lorentz Force of  $\mathbf{F} = q\mathbf{E} + q\mathbf{v} \times \mathbf{B}$ , *simple enough* to be fully understood by anyone, and everyone, of us who *sincerely desire* to understand it completely?

Why not?

Are *understandable* things viewed as *simple* things?

Are simple things understandable, *because* of their perceived simplicity?

How does our own human mind work, with *the simple set of things* that can be fully understood by our own human mind?

Is this *understandable* Occam-Razor simplicity, the actual *rock-solid* scientific *foundation*, of *all* human progress here on Earth?

Is this simple concept understandable?

Is our Lorentz  $\mathbf{F} = q\mathbf{E} + q\mathbf{v} \times \mathbf{B}$  Force *understandable*?

Is our Lorentz Force *simple enough* to be easily comprehended by *all* of us bright mortal-human *scientists* of Earth?

Yes.

Okay then.

We can now simply proceed *to use it* (our One Lorentz  $\mathbf{F} = q\mathbf{E} + q\mathbf{v} \times \mathbf{B}$  Force) to better understand what *may* have happened in 1922, with the famous Stern-Gerlach magnetic experiment, that had a *spatially-varying* magnetic field  $\mathbf{B}(\mathbf{x})$ .

### **The Spatially-Varying Magnetic Field $\mathbf{B}(\mathbf{x})$**

For the special magnetic case of 1922, the stationary Stern-Gerlach (SG) magnet did *Not* change its magnetic field  $\mathbf{B}(\mathbf{x}) = \mathbf{B}(x, y, z)$  in *time*  $t$ .

This stationary 1922 SG magnetic field  $\mathbf{B}(\mathbf{x}) = \mathbf{B}(x, y, z)$  did *not* change in time; but it *did change* in  $x$  space, and it *did change* in  $y$  space, and it *did change* in  $z$  space.

As a matter of fact, Otto Stern and Walther Gerlach specifically designed their 1922 SG magnet to *maximize* the *spatial gradient* of the magnetic field, to produce an *inhomogeneous* magnetic field that was as *strongly* spatially-varying as possible.

By their *intentional design*, their 1922 SG magnetic field  $\mathbf{B}(\mathbf{x})$  had a *different* magnetic-field *direction* for each distinct spatial location  $\mathbf{x} = (x, y, z)$ .

Also, by their *intentional design*, their 1922 SG magnetic field  $\mathbf{B}(\mathbf{x})$  also had a *different* magnetic-field *strength* for each distinct spatial location  $\mathbf{x} = (x, y, z)$ .

This stationary 1922 Stern-Gerlach magnetic field  $\mathbf{B}(\mathbf{x})$ , did *not* change in time; but it did spatially change *a whole lot*, in magnetic strength and in magnetic direction, as one moved to different locations in space  $\mathbf{x} = (x, y, z)$  inside the SG magnet.

Now we can ask this very important scientific question:

Is this *spatial variation* in the SG magnetic field  $\mathbf{B}(\mathbf{x})$ , what *physically caused* the splitting of the beam of silver atoms in Frankfurt, Germany in 1922?

### **$\mathbf{B}(\mathbf{x})$ Spatial Variation Causes Beam Splitting**

It is actually fairly easy to see that it is indeed the *spatial variation* (of the Stern-Gerlach magnetic field) that is the actual *physical thing*, that *physically causes* the one single initial beam of physical silver atoms to *split* into two final separate physical *beams* inside the Stern-Gerlach magnet.

What is an easy way to see that this must, in fact, *always* be the case, for *any* magnetic experiment, that is *similar-enough*, to the Stern-Gerlach magnetic experiment of 1922?

How can the super-simple Lorentz  $\mathbf{v} \times \mathbf{B}$  Force come to our aid here?

### **The Lorentz $\mathbf{v} \times \mathbf{B}$ Force to the Rescue**

Can a *deeper look* at the Lorentz  $\mathbf{v} \times \mathbf{B}$  Force help us to completely *solve* this initial little Stern-Gerlach Puzzle of 1922, so we can also proceed to logically solve the larger Copenhagen Puzzle of 1922-1927?

The *correct answer* appears to be a resounding *YES!*

For example, in the special case of the Stern-Gerlach magnetic experiment of 1922, the Electric Field  $\mathbf{E}$  was effectively *zero*, so we can simply let  $\mathbf{E} = 0$  and simply write

$$\mathbf{E} = 0.$$

And therefore, our Lorentz Force simplifies to

$$\mathbf{F} = q\mathbf{v} \times \mathbf{B},$$

with

$$\mathbf{F} = \mathbf{F}(\mathbf{x}, t) = q \mathbf{v}(\mathbf{x}, t) \times \mathbf{B}(\mathbf{x}).$$

This shows that  $\mathbf{F}(\mathbf{x}, t) = q \mathbf{v}(\mathbf{x}, t) \times \mathbf{B}(\mathbf{x}) = \mathbf{Force}$  on the Silver-Atom Unpaired *Outer Electron*, with its Outer-Electron Velocity  $\mathbf{v}(\mathbf{x}, t)$ , and with its electric charge  $q$ , at spatial location  $\mathbf{x} = (x, y, z)$  and time  $t$ ; and with the magnetic field  $\mathbf{B}(\mathbf{x})$  being a stationary, *spatially-varying* inhomogeneous magnetic field.

### **Lorentz $\mathbf{v} \times \mathbf{B}$ Force with Newton $\mathbf{F} = m \mathbf{a}$ Force**

Let's go ahead and set the *magnetic* Lorentz  $\mathbf{v} \times \mathbf{B}$  Force of 1895, fully equal to the *inertial* Newton  $\mathbf{F} = m \mathbf{a}$  Force of 1687, to get a simple mathematical equation, that mathematically balances the physical *inertial force* with the physical *magnetic force*, to obtain

$$\mathbf{F}(\mathbf{x}, t) = q \mathbf{v}(\mathbf{x}, t) \times \mathbf{B}(\mathbf{x}) = m \mathbf{a}(\mathbf{x}, t),$$

with

$q =$  *electric charge* of the unpaired outer *electron*,

$m =$  *mass* of the unpaired outer *electron*,

$\mathbf{a}(\mathbf{x}, t) =$  *acceleration* of the unpaired outer *electron*,

$\mathbf{v}(\mathbf{x}, t) =$  *velocity* of the unpaired outer *electron*,

$\mathbf{x}(t) =$  *location* of the unpaired outer *electron*,

with

$\mathbf{B}(\mathbf{x}) =$  **Magnetic Field** *pushing*, and *torquing*, and *pulling* on the unpaired outer *electron* via its spatially-varying *Magnetic Lorentz  $\mathbf{v} \times \mathbf{B}(\mathbf{x})$  Force*,

and

**F** (**x**, t) = **Magnetic Lorentz Force** *pushing*, and *torquing*, and *pulling* on the unpaired outer electron, and trying to *accelerate* the electron velocity, and trying to *change* the electron location; and in the process (because the unpaired outer electron is electrically *bound* to the whole neutral *silver atom*) pushing on the *whole silver atom*, torquing on the whole silver atom, pulling on the whole silver atom, and in the process, accelerating the velocity of the whole silver atom, and *changing* the *location* (and *spin-orientation*) of the *whole silver atom*.

The **acceleration** **a** (**x**, t) of the unpaired outer electron, is the *time derivative* of the **velocity** **v** (**x**, t) of the unpaired outer electron, which is the *time derivative* of the **location** **x** (t) of the unpaired outer electron of the whole neutral silver atom.

### **Integrating over a Full *Electronic Orbit***

If we so desire, we can choose to simply *integrate* this simple mathematical equation:

$$q \mathbf{v} (\mathbf{x}, t) \times \mathbf{B} (\mathbf{x}) = m \mathbf{a} (\mathbf{x}, t),$$

over the exact *electron-path* of the *unpaired outer electron* as it moves through time t and space **x** = (x, y, z), and changes its electron spatial location **x** = (x(t), y(t), z(t)), over all the times (t), and over all the spatial electron-position locations x(t), y(t), and z(t), of a *full electron orbit* (with its electron location **x** (t), electron velocity **v** (**x**, t), and electron acceleration **a** (**x**, t), all *changing dynamically* in time t and space **x**, during one single *full electron orbit* around the *outer parts* of the entire neutral silver atom) of the 1913 Bohr Atomic Electronic Orbital Model (that was certainly available to both Otto Stern and Walther Gerlach since 1913), inside the unique *spatially-varying* magnetic geometry **B**(**x**) of the Stern-Gerlach magnet of 1922.

## A Much Easier Way

However, there is actually *a much easier way* to mathematically (and physically) *demonstrate* that this simple Lorentz Force

$$\mathbf{F}(\mathbf{x}, t) = q \mathbf{v}(\mathbf{x}, t) \times \mathbf{B}(\mathbf{x}) = m \mathbf{a}(\mathbf{x}, t),$$

must *always* induce a **nonzero** (finite) **acceleration**  $\mathbf{a}(\mathbf{x}, t)$ , on the *entire* neutral silver *atom*, causing this whole silver atom to *continually change* its *spatial location*  $\mathbf{x} = (x, y, z)$ , while any part (or any atomic subregion) of this entire neutral silver atom is located *anywhere* near the Stern-Gerlach magnet's powerful *north pole*, or powerful *south pole*.

## Spatially-Varying *Inhomogeneous* Magnetic Field $\mathbf{B}(\mathbf{x})$

In order to successfully and *more easily* do this, we must keep in mind that the *key physical concept* of these **two poles** (the north pole and the south pole of the **inhomogeneous** Stern-Gerlach magnet) will almost invariably *push* (and *pull* and *torque*) on different **atomic subregions** (of the neutral silver atom) *differently*, due to the strong spatial **inhomogeneity** of the 1922 Stern-Gerlach (SG) magnet.

For example, when a single individual neutral silver atom is located somewhere inside the Stern-Gerlach magnet, it is logical that there will always exist a “**North Side** outer-shell *atomic region*” of the outer electronic shell of the silver atom, which is located spatially *closer* to the *SG North Pole* of the Stern-Gerlach magnet, than it is to the *SG South Pole* of the magnet.

Likewise, it is also logical that there will also always exist a “**South Side** outer-shell *atomic region*” of the outer electronic shell of the silver atom that is located closer to the *SG South Pole* of the Stern-Gerlach magnet, than to the *SG North Pole* of the magnet.

In this way, the **North Side** is the *northern* side of the silver atom that is closest to the *SG North Pole*, and the **South Side** is the *southern* side of the silver atom that is closest to the *SG South Pole*.

## A Silver Atom and its Unpaired Outer Electron

Some atomic scientists believe that an individual silver atom might have an atomic radius of about *144 picometers*.

The tiny *Compton wavelength* (from Arthur Holly Compton of 1892-1962) of an *electron* is only about *2.43 picometers*.

Might this theoretically indicate that a silver atom might be *nearly* a couple of orders of magnitude *larger* than an electron?

However, the larger *DeBroglie wavelength* (from Louis DeBroglie of 1892-1987) of an *electron* can often become much *larger* than just 144 picometers, for slowly moving electrons.

Is it therefore theoretically possible that this could indicate, in a *physical* sense, that a single individual slow electron might *sometimes* be *larger* than a whole silver atom.

### Which is Larger?

So, *which is larger*, the unpaired *outer* electron, or the *whole* silver atom?

Or are these two real, *physical things* approximately the *same size*?

How can we *know*, scientifically, for sure?

Some scientists might be tempted to claim that the *unpaired outer electron* moves through space in such a way, that it is forced to *continuously* move through space, as the *outer electron* in the *outer regions* of the silver atom.

How does that *neutral*, magnetic *silver atom* really *move and twist*?

How does its *unpaired*, charged, magnetic *outer electron* really *move and twist*?

## Which Moves Faster?

Which moves *faster*, a silver atom, or its unpaired outer electron?

What do *you* think?

Can a whole atom move *faster* than one of its very *own* electrons?

*How exactly* does an unpaired outer electron *move around* its silver atom?

What is the physical *orbital pattern* of this outer electron?

Can this physical orbital pattern *change*, if this outer electron were ever to become spin-paired with another outer electron?

What kind of magnetic field can cause an electronic orbital pattern to *try* to *change*?

What is the actual *velocity* of the unpaired outer electron, of a neutral silver atom?

Can a *bound electron* really have a *velocity*, even if it is *tightly bound* to an atom?

## Electron Velocity

Some scientists still believe that an electron can have a *velocity*, under certain conditions.

Some scientists even believe that an electron can have a *Compton wavelength*, which gives it a *Compton Size*.

Some scientists may also believe that an electron can even have a larger *DeBroglie wavelength*, which gives it a larger *DeBroglie Size*.



## What is Real about the Real Electron?

So, what is the *Real Truth* about the *Real Electron*?

Can a real physical electron really have both a *Size* and a *Velocity*?

Can an individual electron really have actual *physical properties* like location, *size*, position, *velocity*, acceleration, *charge*, mass, angular momentum, spin, *internal physical structure*, and a magnetic dipole moment?

Or can an electron consist of merely a mathematical, uncertain, probabilistic entity, with *no physical properties* whatsoever?

Could an electron possibly have *some* real physical characteristics, but not *all* of them?

What does the *Copenhagen Interpretation* say today in 2023?

What does *Heisenberg Uncertainty* still say today?

What does *Quantum Superposition* say?

What does *Wavefunction Collapse* say?

What does *Spin Quantization* say?

What does *Space Quantization* say?

What did *Otto Stern* say in his day in 1922?

What did *Walther Gerlach* say in his day in 1922?

What did *Werner Heisenberg* say in his day at Solvay in 1927?

What did *Max Born* say in his day at Solvay in 1927?

What did *Niels Bohr* say in his bright day in 1913, and also at Solvay in 1927?

What did *Louis DeBroglie* say in his day at Solvay in 1927?

What did *Arthur Holly Compton* say in his day in 1927?

What did *Albert Einstein* say in his day in 1950?

What did *Erwin Schrodinger* say in his day in 1935?

What did *Stephen Hawking* say on his last day in 2018?

What does *Juan Maldacena* now say today?

What does *Leonard Susskind* now say today?

What do *You Yourself* say today?

What does the Old *1913 Bohr Atom Model* say?

What does our New *2023 Atom Model* say?

What will the exciting new set of *Atomic Pulse Experiments* of 2024 say?

Who can say which is the *Right Way*?

Who?

### **Silver Atom Size and Velocity**

How about a *Silver Atom*? Can it have both a *Size* and a *Velocity*?

What about the *unpaired outer electron* of a Silver Atom? Can it also have *both* a size and a velocity?

Can the *size* of the outer electron, and the *size* of the whole silver atom, somehow be *related* to each other?

Can the *velocity* of the silver atom, and the *velocity* of its outer electron, ever become *associated* with each other?

How do they both *behave* themselves in the *spatial presence* of a very strong *inhomogeneous* magnetic field?

Can the super-strong, ***spatially-varying*** magnetic field  $\mathbf{B}(\mathbf{x})$  of a Stern-Gerlach magnet ever become powerful enough to even reach ***all the way*** into the *interior* atomic *regions* of a silver atom, as well as reach deeply into the *outer reaches* of its unpaired *outer* electron, and thus ***deeply affect*** the *velocity* (with its electric charge) of this *unpaired outer electron*?

## The $\mathbf{v} \times \mathbf{B}$ Force on an Unpaired *Outer* Electron

Can we all finally say **YES**, the *velocity* of the unpaired outer electron *may* become *modified* by this *spatially-varying* magnetic field  $\mathbf{B}(\mathbf{x})$ ?

Why not?

What about the  $\mathbf{v} \times \mathbf{B}$  Lorentz Force -- can this force *alter* a velocity  $\mathbf{v}$  in some way? Can it even *forcefully-modify* the velocity  $\mathbf{v}$  of the unpaired outer electron?

Is this possible in our real *physical* world?

Why not?

Can this mighty Lorentz force *change* the velocity  $\mathbf{v}$  of the *unpaired* outer electron in a *gradual, gentle enough* manner, so that this unpaired outer electron always remains *bound* to its silver atom?

## $\mathbf{v} \times \mathbf{B}$ Force Transfer from Electron to Silver Atom

When this  $\mathbf{v} \times \mathbf{B}$  force starts putting a *physical force* on the unpaired outer electron, can *some* of this force also become **transferred** to the whole silver atom, because the unpaired outer electron is still **tightly bound** to the entire silver atom?

Is this **force-transfer** logically and *physically* possible?

The obvious answer is **Yes!**

Given how *tightly bound* the electron is to the atom, how can a magnetic  $\mathbf{v} \times \mathbf{B}$  force on an unpaired outer electron *forcefully translate* into a  $\mathbf{v} \times \mathbf{B}$  force on a whole silver atom?

How can this magnetic  $\mathbf{v} \times \mathbf{B}$  force apply a *different force* to the unpaired outer electron at each *different location* (different electronic orbital phase), as it moves about the *outer regions* of the silver atom?

## The Outer Orbital Regions of the Unpaired Electron

Is this possible? Do the magnetic forces on the unpaired outer electron of the silver atom actually *vary* with *every different location* and with *every different orbital phase* of its outer regional electronic orbits?

The real *physical* reason that each electronic orbital region (*orbital phase*) feels a *different magnetic force*, is because the strength and direction of the magnetic field is *physically different* for each distinct orbital phase (electron orbital region) of the unpaired outer electron's orbit around the outermost regions of the silver atom.

### Our Universal Lorentz $\mathbf{v} \times \mathbf{B}$ Force works for *All* Atomic Models

Our universal Lorentz  $\mathbf{v} \times \mathbf{B}$  Force works adequately well, for *All* the various *atomic models* of the *past dozen decades*.

Therefore, this *universal* Lorentz  $\mathbf{v} \times \mathbf{B}$  Force even *works well enough*, so that it really does *Not* matter whether you *choose to believe* that an electron's angular momentum, and its associated magnetic dipole moment, are always mostly associated with an electron's *intrinsic spin*; or you rather *choose to believe* that an electron's angular momentum, and its associated magnetic dipole moment, are sometimes mostly associated with its spatially-extended *atomic orbits*.

Also, this universal Lorentz  $\mathbf{v} \times \mathbf{B}$  Force is physically *strong enough*, so that it does *Not* even matter whether you *choose to believe* that electrons and atoms are comprised of *specifically-defined spatial sizes*, or rather *size-less point particles*, or even if you firmly believe they are cosmically *limited* to merely consist of some mathematically-defined *probabilistic-cloud* wavefunctions.

Some may *still believe*, in 2023, that many valid scientific arguments can be rationally made for any, or all, of these wildly *diverse viewpoints*.

A principal tenet of this *Goodbye Copenhagen* article, is that the Lorentz  $\mathbf{v} \times \mathbf{B}$  Force is a *Real Physical Force* that is *ever prevalent*: an infallible, *fundamental*, and immutable law of nature that helps us to *govern* the entire universe; it can *never* be wisely dismissed or physically ignored, and it effectively renders an *unconditional acceptance* of the Copenhagen Interpretation of quantum physics as an *irrational attachment* to an obsolete interpretation of physical quantum reality.

## The Lorentz $\mathbf{v} \times \mathbf{B}$ Force can *Never Be Wisely Dismissed*

This mighty Lorentz  $\mathbf{v} \times \mathbf{B}$  Force is a *Real Physical Force* of Nature. It can *reach deeply* into every electron, *every atom*, every electronic orbital, every electron *intrinsic spin*, every electron intrinsic magnetic dipole moment, every atomic orbital, *every atomic nucleus*, every proton, every neutron, every up quark, and every down quark, and even deeply into the *inner regions* of these tiny, *sub-nuclear*, electronically-charged, moving *quark particles*.

Only the *very finest* Faraday Cage could possibly shield you, me, or any of us, from the *deeply penetrating power* of this *universal* Lorentz  $q\mathbf{v} \times \mathbf{B}$  Force.

## Can this Lorentz $\mathbf{v} \times \mathbf{B}$ Force be Turned Off?

The *only way to turn off* this deeply pervasive Lorentz  $q\mathbf{v} \times \mathbf{B}$  Force, is to *physically set* some *vital part* of it to *zero*.

For example, charge  $q = 0$ , velocity  $\mathbf{v} = 0$ , magnetic field  $\mathbf{B} = 0$ , or vector-cross-product  $\mathbf{v} \times \mathbf{B} = 0$ , would certainly be physically setting a vital part to *zero*.

However, in the special magnetic case of the 1922 Stern-Gerlach Experiment we have the following:

The Unpaired Outer Electron Charge  $q$  is *never zero*,

The Unpaired Outer Electron Velocity  $\mathbf{v}$  is *never zero*,

The Stern-Gerlach Magnetic Field  $\mathbf{B}$  is *never zero*,

The vector-cross-product of  $\mathbf{v} \times \mathbf{B}$  is only occasionally *briefly zero* for just a set of very *small* super-brief moments in *time* when  $\mathbf{v}$  is exactly *parallel* (or exactly *antiparallel*) to  $\mathbf{B}$ .

In other words, this deeply penetrating  $q\mathbf{v} \times \mathbf{B}$  force will (*nearly always*) have a huge *forceful* physical effect on the *physical behavior* of the unpaired outer electron, of a silver atom.

There is *no way* to avoid this.

Otto Stern and Walther Gerlach could *Not* avoid this in 1922.

*We cannot* avoid this in 2023.

This  $q\mathbf{v} \times \mathbf{B}$  force will *always* control the *interior* dynamics (and *exterior* dynamics) of an electron, and of the particular atom to which it belongs.

### **An Unpaired Outer Electron *has* Physical Properties**

An unpaired outer electron has a set of *Real Physical Properties*.

For example, an unpaired outer electron has a *charge*  $q$ , a *mass*  $m$ , a *velocity*  $\mathbf{v}$ , an *acceleration*  $\mathbf{a}$ , and a *position* in space  $\mathbf{x}$ .

To deny this is to deny the *physical existence* of the *electron* -- to deny *reality* itself.

So, what will it be?

Will we the physicists (of Earth) *continue* to deny the electron?

Or shall we logically *proceed* with our simple  $q\mathbf{v} \times \mathbf{B}$  force calculation?

How exactly does this simple  $q\mathbf{v} \times \mathbf{B}$  force *modify* the physical *behavior* of a silver atom's unpaired outer electron?

### **Simple Revealing Calculations**

What are some of the *Simple **Revealing** Calculations* we can easily perform today in this 2023 *Goodbye Copenhagen* article, to mathematically demonstrate some of the all-important *behavior modifications*, that are *forcefully placed* upon the unpaired outer *electron*, with its constant charge  $q$ , and with its rapidly changing velocity  $\mathbf{v}$ ?

The Lorentz Force on this outer electron is

$$\mathbf{F}(x, y, z, t) = q\mathbf{E}(x, y, z, t) + q\mathbf{v}(x, y, z, t) \times \mathbf{B}(x, y, z).$$

We can construct a *simple coordinate system* into the magnetic spatial *geometry* of the Stern-Gerlach Magnet, and into the initial flow *direction* of the beam of silver atoms.

### A Simple Coordinate System

How shall we construct our *Simple Coordinate System*?

We can put the exact center of our *Simple Coordinate System* at the exact center of our Stern-Gerlach Magnet (SGM); with the *positive z* direction pointing *upwards* toward the **Top** of the SGM *North Pole*, and with the *minus z* direction pointing *downwards* towards the **Bottom** of the SGM *South Pole*, and with the *positive y* direction pointing **Front** in the *forward* direction of the silver-atom *beam flow*, and with the *minus y* direction pointing **Back** towards the *initial source* of the silver atoms, and with the *positive x* direction pointing to our **Right Side**, if we were facing forwards towards the location that the silver atoms are traveling, and with the *minus x* direction pointing to our **Left Side**.

Now let's consider a single, individual, neutral *silver atom* as being a *sphere* of radius  $r = 144$  *picometers*, with its unpaired outer electron traveling at *velocity*  $\mathbf{v}(x, y, z, t)$  *rapidly* around the *outer edges* of our *spherical silver atom*.

This unpaired *outer* electron travels at a *very high* velocity  $\mathbf{v}(x, y, z, t)$  *speedily* around the *outside* of our *spherical* silver atom.

This unpaired outer electron traverses *many* different *spatial locations* around, and on the *outermost reaches*, of our spherical silver atom.

## 6 Spatial Locations

We can choose to *label* just *six* of these many different *spatial locations*, in order to clearly *illustrate* some of the powerful *forces* and strong *torques*, that the stationary SG Magnetic Field  $\mathbf{B}(x, y, z)$  puts on our rapidly-traveling unpaired outer electron, which is *always moving* speedily *around* its spherical silver atom at its *rapidly-changing* velocity  $\mathbf{v}(x, y, z, t)$ .

Here are *six* different spatial *locations* that our unpaired *outer electron* rapidly visits repeatedly:

- (1) Silver Atom *Top*
- (2) Silver Atom *Bottom*
- (3) Silver Atom *Front*
- (4) Silver Atom *Back*
- (5) Silver Atom *Right*
- (6) Silver Atom *Left*

### *Top Forces & Bottom Forces*

During one of the many *Top* times, when our unpaired outer electron is at the very *Top* of our spherical silver atom, our unpaired outer electron will experience a *Top* Lorentz Force given by

$$\mathbf{F}(\textit{Top}) = q\mathbf{v}(\textit{Top}) \times \mathbf{B}(\textit{Top}).$$

Likewise, during one of the many *Bottom* moments, when our unpaired outer electron is at the very *Bottom* of our spherical silver atom, our unpaired outer electron will experience a *Bottom* Lorentz Force given by

$$\mathbf{F}(\textit{Bottom}) = q\mathbf{v}(\textit{Bottom}) \times \mathbf{B}(\textit{Bottom}).$$



### ***Front Forces & Back Forces***

Also, during one of the many *Front* events, when our unpaired outer electron is at the very *Front* of our spherical silver atom, our unpaired outer electron will experience a *Front* Lorentz Force given by

$$\mathbf{F} (\textit{Front}) = q\mathbf{v} (\textit{Front}) \times \mathbf{B} (\textit{Front}).$$

And similarly, during one of the many *Back* epochs, when our unpaired outer electron is at the very *Back* of our spherical silver atom, our unpaired outer electron will experience a *Back* Lorentz Force given by

$$\mathbf{F} (\textit{Back}) = q\mathbf{v} (\textit{Back}) \times \mathbf{B} (\textit{Back}).$$

### ***Right Forces & Left Forces***

And during one of the many *Right* times, when our unpaired outer electron is at the far *Right* of our spherical silver atom center, our unpaired outer electron will experience a *Right* Lorentz Force given by

$$\mathbf{F} (\textit{Right}) = q\mathbf{v} (\textit{Right}) \times \mathbf{B} (\textit{Right}).$$

And likewise, during one of the many *Left* moments, when our unpaired outer electron is at the far *Left* of our spherical silver atom center, our unpaired outer electron will experience a *Left* Lorentz Force given by

$$\mathbf{F} (\textit{Left}) = q\mathbf{v} (\textit{Left}) \times \mathbf{B} (\textit{Left}).$$

## The Bohr Atom of 1913

According to the Bohr Atomic Model of 1913, with the Bohr electrons traveling around the atomic nucleus in exactly *circular orbits*, we can deduce that for every *Bottom* moment that *directly follows* a particular *Top* time, we must have our unpaired outer electron traveling at the very *Top* of its orbit in one particular direction, with its electron *Top* velocity  $\mathbf{v} = \mathbf{v}(\text{Top})$ , as this outermost electron moves around the outermost regions of the spherical silver atom, and then continues moving on down to the very *Bottom* of its atomic orbit, where its velocity  $\mathbf{v} = \mathbf{v}(\text{Bottom})$  must be in exactly the *opposite* direction with  $\mathbf{v} = \mathbf{v}(\text{Bottom}) = -\mathbf{v}(\text{Top})$ .

This is *physically* logical, because this is *exactly* how a physical *circular orbit* works.

*Who* can dispute this rationally?

Not us!

## Opposite Electron Velocities

Therefore, we must have

$$\mathbf{v}(\text{Top}) = -\mathbf{v}(\text{Bottom})$$

and this would certainly cause the whole silver atom to experience *only* a simple sinusoidal (*eikonal*) precession of its spin direction -- were it *Not* for the *spatial variation* in the Stern-Gerlach Magnetic Field.

Back in 1922, did Otto Stern and Walther Gerlach *somehow forget* that their magnet had a strong *spatial variation*?

Did Otto Stern and Walther Gerlach *somehow forget* that this magnetic *spatial variation* (magnetic inhomogeneity) means that:

$$\mathbf{B}(\text{Top}) \text{ does Not equal } \mathbf{B}(\text{Bottom}).$$

## **B (Top) does Not equal B (Bottom)**

This all-important *vital fact* is that the strength (and direction) of the magnetic field **B (Top)** at the very *Top* of the outer electron orbit is *not the same* (does not equal) as the strength (and direction) of the magnetic field **B (Bottom)** at the very *Bottom* of the outer electron orbit.

## **The Consequence of this Magnetic Spatial Variation**

This *Magnetic Spatial Variation* (the fact that **B (Top)** does not equal **B (Bottom)**) has some very *huge* mathematical (and physical) *consequences*.

Here are the magnetic Lorentz Force mathematical consequences:

$$\mathbf{F} (Top) = q\mathbf{v} (Top) \times \mathbf{B} (Top),$$

$$\mathbf{F} (Bottom) = q\mathbf{v} (Bottom) \times \mathbf{B} (Bottom),$$

Therefore, we have

$$\begin{aligned} \mathbf{F} (Top) + \mathbf{F} (Bottom) &= \\ q\mathbf{v} (Top) \times \mathbf{B} (Top) + q\mathbf{v} (Bottom) \times \mathbf{B} (Bottom) &= \\ q\mathbf{v} (Top) \times \mathbf{B} (Top) - q\mathbf{v} (Top) \times \mathbf{B} (Bottom) &= \\ q\mathbf{v} (Top) \times \{\mathbf{B} (Top) - \mathbf{B} (Bottom)\}, & \end{aligned}$$

where we have made the simple substitution

$$\mathbf{v} (Bottom) = -\mathbf{v} (Top).$$

## The Total Magnetic Force on the Silver Atom

This means that the *Total Magnetic Force* on a neutral *Silver Atom* (averaged over just one full unpaired-outer-electron orbit) will contain this (Top + Bottom) *forceful contribution*:

$$\mathbf{F}(\text{Top}) + \mathbf{F}(\text{Bottom}) = q\mathbf{v}(\text{Top}) \times \{\mathbf{B}(\text{Top}) - \mathbf{B}(\text{Bottom})\}$$

and we can see that the simple *magnetic difference* term:

$$\{\mathbf{B}(\text{Top}) - \mathbf{B}(\text{Bottom})\} \text{ does } \textit{Not} \text{ equal } \textit{zero}$$

because the magnetic field  $\mathbf{B}$  at the very *Top* of the spherical silver atom is  $\mathbf{B} = \mathbf{B}(\text{Top})$  which is *very different* from the magnetic field  $\mathbf{B}$  at the very *Bottom* of the spherical silver atom which is  $\mathbf{B} = \mathbf{B}(\text{Bottom})$ .

## The Silver Atom is *Forcefully Pushed* to a New Location

This means that this *nonzero* (Top + Bottom) *forceful contribution* will simply *push* the silver atom to a *new location* inside the Stern-Gerlach magnet of 1922.

This is a *big part* of the *full Lorentz reason* why the beam of silver atoms will *always split* into two beams, when the initial incoming beam is *properly balanced* between the north pole, and the south pole, of the spatially-varying Stern-Gerlach magnet of 1922.

## Beam Splitting is *Not* caused by Space Quantization

Initial Space Quantization is *Not* the reason for the beam splitting.

The *spatially-varying* Magnetic Lorentz Force *is* the *utterly-simple Real Physical Reason* for the beam splitting.

This is how the SG magnet *worked* in February 1922.

This is also how *all* SG magnets *still work* today in 2023.

*All* magnetic *beam splitting* is physically *caused* by the spatially-varying *Lorentz Force*.

## Excessive Congratulatory Excitement

This could have been *easily realized* in 1922, by Otto Stern and Walter Gerlach, and the *many* scientists surrounding them, encouraging them, *pressuring them*, and excitedly congratulating them, if *just one* of them, would have *chosen* to take the time to *think clearly*, and to think carefully, and to think logically, and to *think scientifically*, and to think rationally about the simple *magnetic* beam-splitting *effect* of the spatially-varying (*inhomogeneous*) Magnetic Lorentz Force.

Somehow this spatially-varying Magnetic Lorentz Force was *lost to all*, in all the intense *academic pressures* and excessive congratulatory *excitement* of February 1922.

What is even *more unfortunate* for *us all*, is that this misplaced *enduring* congratulatory excitement has actually *endured* for a *full* bewildered *century*, from 1922 to today in 2023, causing multiple generations of well-meaning physicists to start believing in *Initial Space Quantization*, and to incessantly *nudge them* (via intense scientific peer pressure) to also start believing in something *even more irrational*, called *Initial Physical Quantum Superposition*.

## Physical Quantum Superposition does Not exist.

It is actually very easy to see that *Physical Quantum Superposition* does *Not* exist.

There are *many* different ways to come to this simple, logical, wise conclusion.

Albert Einstein was able to *clearly see this* in 1935 and in 1950.

We can *all begin* to *clearly see* it *today* in 2023, by carefully reading this whole *Goodbye Copenhagen* article multiple times, and by thinking about it very carefully, with a *clear head*, and an *open mind*.

## Good Clear Thinking *is* Really Needed

*Good Clear Thinking* is the **only thing** that is actually *needed*, to properly say a final *Goodbye* to the absurd Copenhagen Interpretation of Quantum Physics.

The *simple set* of powerful *clear concepts*, presented in this *Goodbye Copenhagen* article of 2023, can *help us all* to discover our very own Good Clear Thinking.

For example, we clearly see that *Final* Physical Quantum Superposition does *not exist* because *Initial* Physical Quantum Superposition does *not exist*.

## PQS *cannot exist* in our Universe

As a matter of *clear logical physical fact*, we can all clearly see that it is actually impossible for any type of *Physical Quantum Superposition (PQS)* to exist.

Why is it physically **impossible** for any type of **PQS** to *exist* in our universe?

The **real** physical **reason** that **PQS** can *never* exist in our real physical universe of real physical particles and real physical things, is because we all live in a real physical universe that contains a set of real *physical things* that have **real physical properties** that simply **Cannot Self-Contradict** in any way, shape, or *physical form*.

## Reality *Excludes* ALL Self-Contradictions

*Reality* is our *real physical universe*, and everything that supports it, including *everything* connected to it in any way.

This Reality **Excludes** ALL Self-Contradictions.

The only way to have a **stable** physical reality (with **stable** computational physical **qubits**) is to **exclude** all *self-contradictions*, which is excluding *all* logical physical *impossibilities* like *physical quantum superposition*.

We can all clearly see, if we are **just honest** with ourselves, that it is *physically impossible* for an electron to *be both* spin up (with its electron magnetic *dipole* orientation pointing *upwards*) and spin down (with its electron magnetic *dipole* orientation pointing downwards) at the very *same time*, in the very *same way*.

### **Self-Contradictions are Wrong Thinking**

The *misconception* that a single individual electron can be *both* spin up, and spin down, at the same time, in the same way, is *self-contradictory* for all to see.

There is *no way* to defend *PQS* in *any* of its forms in the scientific literature.

*PQS* is fundamentally *self-contradictory* at its very *core*.

### **PQS is Wrong Thinking**

*PQS* is *Wrong Thinking*.

This was obvious in 1922 to *all honest thinkers*.

This was obvious in 1927 at the *Solvay Conference* to all honest thinkers.

This was obvious in 1935 to Einstein, Podolsky, and Rosen.

### **PQS Wrong-Thinking *Hurts* our Human Society**

PQS Wrong-Thinking ***Hurts*** our Human Society.

This was ***totally obvious*** in 1935 to Erwin Schrodinger.

This was ***fully obvious*** in December 1950 to Albert Einstein, when he wrote his famous letter to Erwin Schrodinger, and *clearly lamented* that there were apparently ***only 3 honest physicists*** left in the *entire world* at the *end of 1950*.

This *may* possibly have also become obvious in 2016 to Leonard Susskind, when he wrote about quantum mechanics being only a “*provisional theory*”.

This is *fully obvious* to Daniel Reed Cook, and to John Contino, today in 2023; and this is the *real reason* Dr. Cook and Mr. Contino made the *important decision* to work together to write this *Goodbye Copenhagen* article, in their *great hope* that this *Goodbye Copenhagen* article will be read widely by enough people, so it can begin to really *help* this whole wide world *awaken* from the wrong thinking of *PQS*, because this type of wrong thinking is actually *hurting* our whole human civilization here on Earth in *many* ways; and this type of *wrong PQS thinking* is *holding back* the forward progress of science in many ways, and this type of wrong *PQS thinking* is making it *exceedingly difficult* for the diligent hard-working physicists to properly *stabilize* all their valuable computational *qubits* inside their wonderful new quantum computers, that may soon have the power to *help us all* one day in our *mutual future* here on planet Earth.

### **This Will Soon Become *Fully Obvious* to All**

This *will soon* become *fully obvious* to *anyone* on this Earth, who *carefully* reads this *Goodbye Copenhagen* article, with a clear, honest, *open mind*.

There are so *many good* ways to see this clearly.

For example, if a magnetic dipole is *both* up and down, at the very same time, then the Lorentz  $\mathbf{v} \times \mathbf{B}$  magnetic Lorentz force will *not know* which way to *push* the dipole, and the Lorentz magnetic force will also *not know* which way to *torque* the dipole.

This will render our mighty Lorentz  $\mathbf{v} \times \mathbf{B}$  magnetic force *useless* as a *tool* for mathematical *calculations*, and also useless as a *real* physical *force* in this physical universe.

Is this really what *we want*?

Will we the people *forever* choose insanity?

Or, will *we start* to choose reality today in 2023?



## Attempted Intellectual Degradation

Such an attempted intellectual *degradation* of the Lorentz  $\mathbf{v} \times \mathbf{B}$  magnetic force, can *hypnotize us all* into a type of bewildered **magical** thinking, where we are emotionally tempted to *deny* the *solid reality* of the Lorentz  $\mathbf{v} \times \mathbf{B}$  magnetic force, in favor of a whole boatload of fanciful **mystical notions** about *pretended* physical quantum *superpositions* of **both** spin up and spin down, and the *perceived necessity* of a pretended *wavefunction collapse* to pretend to *physically-collapse* the pretended physical quantum superposition, back into our actual physical reality, of this actual real physical universe, where the real, rock-solid, physical Lorentz  $\mathbf{v} \times \mathbf{B}$  magnetic force can then *once again* become real and solid, in the real physical way it *magnetically acts* on *all* of the elementary magnetic-dipole spins, including the unpaired outer electron magnetic dipole moment of a neutral silver atom.

## Goodbye PQS

We can all begin to say **Goodbye PQS** by saying **Goodbye Copenhagen** Interpretation of Quantum Physics.

This present 2023 article, titled *Goodbye Copenhagen*, can help us *all* awaken to the simple realization, that saying a final goodbye to the Copenhagen Interpretation of Quantum Mechanics, can be as easy as committing to ourselves, and to each other, our renewed *willingness* to begin to think *more* logically, and more carefully, and much *more clearly* about what *we the people* of Earth are willing to *let ourselves believe*.

We, the thinking people of Earth, are **not required** to believe in absurd nonsense anymore!

*We can all learn* how to think *clearly* and wisely for ourselves, for those we love, and for the *mutual scientific benefit* of **all** of humanity *equally*.

So let it be written. So let it be done!

## The Lorentz Force *destroys* PQS

The *Lorentz Force* completely destroys *PQS*, when we *look* at it *closely*.

The real solid Lorentz  $\mathbf{v} \times \mathbf{B}$  magnetic force totally *demolishes* every trace of PQS (physical quantum superposition) from *our minds*, just as quickly as we are willing to study the core *mathematical* (and physical) nature of this mighty *Magnetic Lorentz Force*.

For example, we have already seen that in the SG magnetic experiment of 1922, we have

$$\mathbf{B} (Top) - \mathbf{B} (Bottom) \text{ does not equal zero,}$$

because

$$\mathbf{B} (Top) \text{ does not equal } \mathbf{B} (Bottom),$$

because the magnetic field  $\mathbf{B} = \mathbf{B} (Top)$  at the very *Top* of the silver atom is in a *different* magnetic field *direction*, with a *different* magnetic field *strength*, than the magnetic field  $\mathbf{B} = \mathbf{B} (Bottom)$  at the very *Bottom* of the silver atom.

This is logical, and this is rational, and this is physical because the magnetic field is different at every different location in space, inside the Stern-Gerlach (SG) magnet of 1922.

Therefore,

$$\begin{aligned} Top + Bottom \text{ Total Force} &= \\ &= \mathbf{F} (Top) + \mathbf{F}(Bottom) \\ &= q\mathbf{v} (Top) \times \{\mathbf{B} (Top) - \mathbf{B} (Bottom)\} \\ &= \text{Not Zero.} \end{aligned}$$

This means that

$$Top + Bottom \text{ Total Force} = \text{Not Zero,}$$

which means that the combined Total Force of the Top Force  $\mathbf{F} = \mathbf{F} (Top)$  (on the unpaired outer electron) *plus* the Bottom Force  $\mathbf{F} = \mathbf{F} (Bottom)$  (on the unpaired outer electron) is **Not Zero!**

## The Total Average Lorentz Force is Not Zero

The *Lorentz Force* completely destroys *PQS*, when we *look* at it *closely*, because when we look closely at the **Total Average Lorentz Force** (on the unpaired outer electron, and thereby also on the silver atom it is so tightly bound to) on the whole silver atom, we can clearly see that it is **Not Zero**, so the entire silver atom is *pushed*, and *torqued*, in *many ways*, as it moves through the SG magnet, so there is **nothing** mysterious about this magnetic Lorentz force, so there is **no intellectual need** (and no emotional need) to *appeal* to any magical *self-contradictory ideas* like the self-contradictory *PQS ideas*.

For an *additional example* of this *clear Lorentz fact*, we can simply calculate the *average of two things*, by adding them up, and dividing by a factor of 2.

Therefore,

$$\textit{Top} + \textit{Bottom Average Force} = (\text{Not Zero})/2,$$

Which is still **Not Zero**.

Likewise, if we do **all** the other  $\mathbf{v} \times \mathbf{B}$  mathematical calculations *very carefully*, in the very end, we will all easily discover that

$$\textit{Top} + \textit{Bottom Total Force} = \text{Not Zero}$$

$$\textit{Front} + \textit{Back Total Force} = \text{Not Zero}$$

$$\textit{Right} + \textit{Left Total Force} = \text{Not Zero}$$

And that

$$\textit{Top} + \textit{Bottom Average Force} = (\text{Not Zero})/2,$$

$$\textit{Front} + \textit{Back Average Force} = (\text{Not Zero})/2,$$

$$\textit{Right} + \textit{Left Average Force} = (\text{Not Zero})/2,$$

Also, if we generally consider *any chosen* very-specific physical *Direction D*, directed from the exact *center* of a spherical silver atom, and *pointing outward* in some exact specific *Direction D*, then we will also *always* discover that

**D + Anti D Total Force = Not Zero**

**D + Anti D Average Force = (Not Zero)/2**

Also, if we properly multiply *all* of these forces, by the distance from the center of a silver atom to the *radial location* of the unpaired outer electron, to transform all of these *forces* into *torques*, then we will also discover that

**D + Anti D Total Torque = Not Zero**

**D + Anti D Average Torque = (Not Zero)/2**

### **Many Differing Torques on the Silver Atom**

This means that when **any silver atom**, with its unpaired outer electron, enters the Stern-Gerlach Magnet, it will continually experience, a continuous set of *differing torques*, that will cause the silver atom to *twist* and *turn*, as it moves through the Stern-Gerlach Magnet.

### **Many Differing Forces on the Silver Atom**

This also means that when **any silver atom**, with its unpaired outer electron, enters the Stern-Gerlach Magnet, it will continually experience, a continuous set of *differing forces*, that will cause the silver atom to *accelerate*, and *change* its total *velocity*, and also *change* its spatial *position*, as it becomes *deflected* in its *path* from its original direction; as this particular silver atom was originally a part of the initial beam of silver atoms, that first entered the Stern-Gerlach Magnet in 1922.

## A Simple Clear Mathematical Derivation

Our *mathematical derivation* was simple and clear.

Otto Stern and Walther Gerlach could have ***taken the time*** to conduct this simple magnetic Lorentz Force  $\mathbf{v} \times \mathbf{B}$  mathematical calculation *for themselves*, ***before*** they *published* their wild reckless *world-harming* conclusion in 1922.

The *many* other physicists, that quickly learned of their February 1922 claim, could have also ***taken the time*** to conduct this simple magnetic Lorentz Force  $\mathbf{v} \times \mathbf{B}$  mathematical calculation for themselves, ***before*** they *rushed to wildly-congratulate* Otto Stern and Walther Gerlach, and even *before* they started to discuss the possible theoretical meanings of this 1922 Stern-Gerlach result.

## No Reason for Claiming “Space Quantization”

There was ***never*** any good *physical experimental reason* to claim initial *Space Quantization*, or to claim initial physical *Quantum Superposition*, or to claim physical *Wavefunction Collapse*.

This was the case in 1922.

This is *still* the case today in 2023.

## Wild Copenhagen Interpretations

From the historical record, it certainly appears that most of these wild *Copenhagen Interpretations* were invented during 1922-1927, apparently because of an astonishing *widespread willingness to ignore* the universal *pervasive strength* of the  $\mathbf{v} \times \mathbf{B}$  Lorentz Force of 1895; when it is forcefully applied to *charged*, moving, *unpaired* outer *electrons*, to entire neutral *silver* atoms, and to *many* other fundamental quantum particles; that may physically consist of their very own *charged moving inner parts*, that may also be subject to the *deeply-pervasive* influence of this super-powerful universal  $\mathbf{v} \times \mathbf{B}$  Lorentz Force of 1895.

## Non-Eikonal Magnetic Precession

The *Eikonal Approximation* can be made for waves (and wave motions) with *wavelengths* that are *small* compared to the characteristic *scale lengths* of the spatial variations of the *medium* of *wave propagation* or *wave motion*.

This is certainly the case for the SG magnetic experiment of 1922, because the *Electron Compton Wavelength* of the unpaired outer electron is *small* compared to the *scale length* of the *spatial variations* of the SG Magnet of Otto Stern and Walther Gerlach.

Some very important (and *very revealing*) physical quantities, like *total wave action* (and total system *angular momentum*), are *always* conserved, even for *Non-Eikonal Waves*. [14]

For our special case, of the Stern-Gerlach Magnetic Experiment of 1922, the Stern-Gerlach Magnet has *no temporal variation*, because the Stern-Gerlach Magnetic Field does *not* change in time.

Therefore, the Stern-Gerlach *magnetic precession* of the *direction* of the magnetic dipole moment (of the unpaired outer electron) may *sometimes* become somewhat *Eikonal* in time, kind of like a simple *sinusoidal* plane wave.

However, in space, if the *strength* of the Stern-Gerlach Magnetic Field *spatial variation* (spatial gradient) is *strong enough*, in any location inside the Stern-Gerlach Magnet, then the *magnetic precession* of the direction of the magnetic dipole moment (of the unpaired outer electron) may sometimes become *Non-Eikonal*, with interesting *spiral motions* that *dip*, and *nod*, and *pull* the whole silver atom into different spatial regions of the inhomogeneous Stern-Gerlach magnet.

## Non-Eikonal Magnetic Nutation

In addition to the possibility of *Non-Eikonal Magnetic Precession*, it is also possible for the *direction* of the unpaired outer electron to experience a type of *Non-Eikonal Magnetic Nutation*, as it *dips*, it *nods*, it *weaves*, and it *wanders* through the *spatially-changing* magnetic field strength and direction of the powerful Stern-Gerlach Magnet.

The strong magnetic  $\mathbf{v} \times \mathbf{B}$  Lorentz Force *causes all* of these *atomic motions*, as well as the *spiral movements* of the whole spherical neutral *silver atom* into completely-different *spatial regions* of the strong inhomogeneous Stern-Gerlach magnet.

## $\mathbf{v} \times \mathbf{B}$ Magnetic Precession & Nutation

It is very easy to see that the  $\mathbf{v} \times \mathbf{B}$  Lorentz Force is able to *forcefully cause* a tiny magnetic dipole moment (like the unpaired outer electron on a silver atom) to experience a periodic precession (and a *periodic nutation*) in the direction of its tiny magnetic dipole moment.

Because of the detailed mathematical descriptions included in this present “*Goodbye Copenhagen*” article, it should now also become *very easy for all to see*, that the nutation and precession *must also* be accompanied by spatial *changes* in the spatial *locations* of the silver atoms.

This *powerful combination* of spatial location change, nutation, and precession, allow the  $\mathbf{v} \times \mathbf{B}$  Lorentz Force to *forcefully reorient* a tiny magnetic *dipole* towards one of the two big strong Stern-Gerlach Magnetic Poles, and then *forcefully pull* the tiny magnetic dipole (like the tiny unpaired outer electron of a silver atom) towards one of the big strong Magnetic Poles.

## All Tiny Classical Magnets

This is *exactly* what happens to *All* tiny *classical magnets*.

This is exactly what happens to **All** tiny unpaired outer electron dipole magnets.

This is exactly what happens to **All** magnets.

This is exactly what will *always happen* to *all magnets* because of how the magnetic  $\mathbf{v} \times \mathbf{B}$  Lorentz Force works in the physical magnetic nature of our physical magnetic planet we call Earth.

This is how this  $\mathbf{v} \times \mathbf{B}$  Lorentz Force also works in the outer reaches of our whole magnetic physical universe.

## Internal *Inner* Lorentz Forces

This is also *how* this pervasive magnetic  $\mathbf{v} \times \mathbf{B}$  Lorentz Force works in the *inner reaches* inside each elementary particle.

It certainly appears like a better understanding of this universal magnetic  $\mathbf{v} \times \mathbf{B}$  Lorentz Force, can help us to finally solve the *Big Complex Puzzle* that is the 1922-1927 Copenhagen Interpretation of Quantum Physics.

Perhaps a *deeper study*, of this universally-pervasive powerful magnetic  $\mathbf{v} \times \mathbf{B}$  Lorentz Force, will help us all to eventually muster the clear personal understanding, and the scientific courage, to finally say *Goodbye Copenhagen*.

One other very important thing, that can certainly begin to help us all to say *Goodbye Copenhagen*, is our own personal scientific willingness, to simply conduct a few simple experiments with some little magnets, and with some big strong magnets, that are just as strong as the Stern-Gerlach magnets of 1922.



## Our Many Magnetic Experiments

During past *years*, and especially during the past *few months*, we have already conducted a good *Many Magnetic Experiments*, to experimentally test our **2023 Stern-Gerlach Hypothesis** that the unpaired *outer electron* of a neutral silver atom behaves *exactly* like any *classical* magnet is *classically* expected to *classically* behave, in the powerful *spatially-varying* magnetic  $\mathbf{v} \times \mathbf{B}$  Lorentz Force of the strong stationary *inhomogeneous* Stern-Gerlach Magnet of 1922.

We have already *experimentally discovered* that this is indeed *always* the case in each and *every* physical *scientific experiment* we have conducted.

We have also already experimentally demonstrated that a great variety of *classical magnets* behave *exactly* like the neutral silver *atom magnets* of the Stern-Gerlach Magnetic Experiment of 1922.

Our many scientific experiments, in our experimental laboratories, have all been *very conclusive* on this point.

The thousands of neutral *silver atoms* (of 1922) all behaved *classically*, exactly as these tiny *classical magnets* should have behaved in 1922, due to the *classical* magnetic  $\mathbf{v} \times \mathbf{B}$  Lorentz Force of the *classical* Stern-Gerlach Magnet.

There was *no initial physical* Space Quantization in 1922.

There was *no initial physical* Spin Quantization in 1922.

There was *no physical* Quantum Superposition of *any type* for form in 1922.

There was *no physical* Quantum Wavefunction Collapse of *any type* or form in 1922.

There is *no physical* Quantum Wavefunction Collapse of *any type* or form in 2023.

There is *no physical* Quantum Superposition of *any type* or form in 2023.

There is *no initial physical* Spin Quantization in 2023.

There is *no initial physical* Space Quantization in 2023.

This should now be completely obvious to *anyone* who has read this Goodbye Copenhagen article carefully with a *clear open mind*.

## A Wild Bewildering Set of False Concepts

There was *no accurate* Copenhagen Interpretation of Quantum Physics during 1922 to 1927.

Today in 2023, there is *still no accurate* Copenhagen Interpretation of Quantum Physics.

This 96-year-old Copenhagen Interpretation of Quantum Physics is a *wild bewildering set* of false intellectual concepts, that really do *seem absurd* to a layman, because they really *are absurd* to anyone who has the *public courage* to be *scientifically honest*, just like Albert Einstein carefully *explained* in his famous letter to Erwin Schrodinger in December 1950.

We believe that today in 2023, it is now time to say a final *Goodbye* to this tired old *dishonest Copenhagen* Interpretation of Quantum Physics.

## What does Stern-Gerlach really Measure?

Now that we have said a *firm Goodbye* to *Copenhagen*, we can finally start asking the *really important scientific questions*.

For example, *what* exactly does Stern-Gerlach *really measure*?

And, what does Stern-Gerlach *Never* measure?

How can we wise physicists of Earth work together harmoniously, to intelligently construct a better Stern-Gerlach *measuring device*, for the *benefit* of *all* humankind?

How can we, the clear-thinking people of Earth, continue to stay committed to this grand scientific adventure, for long enough, to *fully untangle* each and every Copenhagen-related *puzzle*?

## Copenhagen or Reality?

Copenhagen *violates* our logical sense of Reality.

We, the thinking people of Earth, have an *important choice* we must make alone, in groups, or together as one *unified* human race of thinking people.

Will we continue to *choose* Copenhagen like Werner Heisenberg and Neils Bohr?

Or will we start to *choose* Reality?

This vitally-important *existential choice* is certainly *ours* to make today in 2023.

## Where did we go wrong in our group-think?

So, how did our world-wide *group-think* go so terribly wrong a whole century ago?

It almost appears that *some* of the early *misguided* views of **Energy Quantization** in Atomic Spectroscopy, and the Bohr Atom Model of 1913, may possibly have somehow *influenced* the **Misguided Space-Quantization Thinking** of Arnold Sommerfeld, Max Born, Wolfgang Pauli, Otto Stern, Walther Gerlach, and many other bright minds during the exciting 9-year period from 1913 to 1922.

Many other **powerful pressures** may also have influenced their *Vulnerable Group Thinking* during the *precarious formative years* of the wild, bewildered, *absurd* Copenhagen Interpretation.

Did any of these bright scientific pioneers ever come to really *appreciate* the vital difference between **Initial Space Quantization** and **Final Space Quantization**?

Are we (the thinking minds of Earth) really ready, finally, to say *Goodbye* to the **Copenhagen Interpretation** of Quantum Mechanics today in 2023?

With what **Better Interpretation** will we *replace* it?

*Where* do we scientists of Earth go from here?

What is our *initial conclusion* during this crucial *Goodbye Copenhagen* transition year of 2023?

## Conclusion

In this present *Goodbye Copenhagen* article of 2023, we have provided some *initial compelling evidence* that the Stern-Gerlach magnetic experiment of 1922 **Did Not** establish Initial Physical Space Quantization, **nor** Initial Physical Spin Quantization, **nor** Physical Quantum Superposition, **nor** Wavefunction Collapse, **nor** provide *any* real physical *support* to the Copenhagen Interpretation of Quantum Mechanics *in any way whatsoever*.

We have also provided **substantial evidence** that **neither** Albert Einstein, **nor** Erwin Schrodinger, believed that the Copenhagen Interpretation of Schrodinger's Wavefunction constituted a **complete theory** of quantum physics.

We have also alluded to some *fresh new evidence* that even some of today's *brightest physicists* are beginning to regard the Copenhagen Interpretation as only a **Provisional Theory**, until a **Better Theory** of Quantum Physics arrives here on Earth.

And we have *properly disclosed* that we have been very busy developing a **more complete theory** of *quantum physics* for a good number of productive years now.

At last, we have logically demonstrated, with our clear detailed explanations, that it is becoming increasingly *obvious* that *now* is the time to start saying **Goodbye Copenhagen**.

*How will we the clear-thinking scientists of Earth, begin to develop a Better Theory of Quantum Physics?*

A Better, More-Complete Theory of Quantum Mechanics and Quantum Computing, will require that we *replace* the 96-year-old Mathematical Probabilistic Copenhagen Interpretation with a *fully recognized and detailed physical description* of the dynamic **internal** physical *characteristics* of every useful subatomic particle, including *protons, neutrons, electrons, and photons*.

Our **more complete theory** of quantum physics will also require that we explain in much **greater detail** the actual detailed *dynamic physical interactions* of these 4 *physical stable* subatomic particles with *each other*.

For example, *atomic spectroscopy, nuclear spectroscopy, molecular spectroscopy*, all need to be **completely solved** for *every* atomic **element**, so that *every* faint

spectral *frequency* is completely ***theoretically predicted*** from first principles with *near-perfect accuracy*.

We believe that this *useful goal* can now be realized, based on some recent *scientific discoveries* and *technological inventions*, that were derived both from published theoretical papers, and from some exciting new results, of some powerful new empirical physical experiments in the scientific laboratory.

A more ***complete Quantum theory*** will physically-enable the proper ***stabilization*** of Quantum Bits (*qubits*), which will be required for the development of superfast, super-stable, exact, deterministic *quantum computers*. These computers will inevitably ignite a ***technological revolution*** that can properly benefit *all* of humankind.

We believe that *the very best use* of quantum physics, and quantum computing, can, and hopefully will, *liberate all humankind* from economic slavery and forced servitude, and in the process eliminate ***all*** of the poverty, and *most* of the despair, in this little world of *us 8 billion precious human beings*.

In particular, today in 2023, the interesting arrival of ChatGPT is beginning to *help millions of us* thinking people of Earth, *awaken* to the theoretical possibility that Artificial Intelligent (AI) *can* and will impact our *mutual future*.

We believe that AI systems, like ChatGPT, can become *quantum-upgraded* to run on *super-stable*, trillion-qubit *deterministic quantum computers*, to animate *billions* of future human-brain-mimicking *robots*, that can *learn to perform* almost *all* human labor, to fully liberate *all* humankind (of Earth) from forced economic drudgery.

We have an *important choice* to make together as one *united* human race (all 8 billion of *us* thinking, feeling, choosing *people* of Earth).

Will we *foolishly employ* technology to *continue* to enslave humanity, by making money *more* important than the *starving* human beings, who *need* to eat food to *live*?

Or will we *wisely start to use* our new technologies to *liberate* every human on Earth, by solving world poverty for *everyone* on Earth, by the year 2028?

The choice is ours to make -- today in 2023, and tomorrow in 2028, and forever into our collective future, so long as this Earth planet *somehow continues* to *survive*.

### **About the Authors**

Mr. John M. Contino, and Dr. Daniel Reed Cook enjoy working *together* on creative intellectual projects for the benefit of *all* humankind here on Earth.

They believe that the time is already *ripe*, even today in 2023, to start saying *Goodbye* to the obsolete 96-year-old Copenhagen Interpretation.

Dr. Cook and his talented team have been diligently developing a *more complete theory* of quantum physics, and quantum computation, for many years.

After Dr. Daniel Reed Cook completed his *Ph.D.* in *Physics* from the University of California at Berkeley in May 1993; he focused his intense studies into *many* different areas of science, including the *foundations* of quantum mechanics for 30 years, from 1993 until today in 2023.

Dr. Cook may be reached at [Dan@EyeMynd.com](mailto:Dan@EyeMynd.com).

John Contino completed his *Master of Arts Degree* in *Music Composition* from Michigan State University in 1981.

Mr. Contino may be reached at [John.Contino@TriconGeophysics.com](mailto:John.Contino@TriconGeophysics.com).

### **References**

[1] *The 1927 Solvay Conference on Electrons and Photons*, held in Brussels, Belgium in October 1927.

[2] Erwin Schrodinger, “*Quantization as an Eigenvalue Problem*,” *Annalen der Physik*, Volume 384, Issue 4, pages 361-376 (January 1926)

[3] Erwin Schrodinger, “*The Present Situation in Quantum Mechanics*,” *Naturwissenschaften* 23 (48): pages 807–812 (This is the famous 1935 Schrodinger’s Cat Paper, published in November 1935)

[4] The December 22, 1950 Letter from Albert Einstein to Erwin Schrodinger.

- [5] Walther Gerlach and Otto Stern, “*Der experimentelle Nachweis der Richtungsquantelung im Magnetfeld,*” *Zeitschrift für Physik* 9, 349 (April 1922)
- [6] The January 26, 2023 Paper by Martin Bauer of the University of Durham, U.K. Department of Physics, of his German to English Translation of the 1922 Stern-Gerlach Paper.
- [7] *Space Quantization: Otto Stern’s Lucky Star*, by Bretislav Friedrich and Dudley Herschbach. MIT Press. 1998
- [8] The brief letter that Wolfgang Pauli sent to Walther Gerlach in February 1922 that said “*This should convert even the nonbeliever Stern.*”
- [9] Albert Einstein, Boris Podolsky, and Nathan Rosen, “*Can Quantum-Mechanical Description of Physical Reality be Considered Complete?*” *Physical Review*, volume 47 (10): 777, received on March 25, 1935 (published on May 15, 1935) (This is the original EPR paper of 1935.)
- [10] Juan Maldacena and Leonard Susskind, “*Cool Horizons for Entangled Black Holes,*” *Progress of Physics (Fortschritte der Physik)* 61 (9): pages 781–811 (published on August 1, 2013) (This is the original ER=EPR paper of 2013.)
- [11] Leonard Susskind, “*Copenhagen vs Everett, Teleportation, and ER = EPR,*” *Progress of Physics (Fortschritte der Physik)* 64 (6-7): pages 551–564 (published on June 6, 2016) (This is the ER=EPR paper of 2016.)
- [12] Niels Bohr, “*On the constitution of atoms and molecules*”, published by the *Philosophical Magazine*, Copenhagen, July 1913.
- [13] Hendrik Antoon Lorentz, “*Versuch einer Theorie der elektrischen und optischen Erscheinungen in bewegten Körpern*”, English Translation: “*Attempt of a Theory of Electrical and Optical Phenomena in Moving Bodies*”, University of Leiden: E.J. Brill (1895).
- [14] Daniel Reed Cook, William Greg Flynn, James J. Morehead, Allan Nathan Kaufman, “*Phase-Space Action Conservation for Non-Eikonal Wave Fields,*” *Physics Letters A*, Volume 174, Issues 1-2, pages 53-58, received on October 29, 1992, accepted on December 21, 1992 (published on March 1, 1993).