A Tiered Polynomial Framework for the Emergence of Physical Dimensions

Version 2

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Abstract

We introduce a tiered polynomial framework that models known physical equations through a single, internally self-consistent geometric construction. The system begins with a minimal set of rules derived directly from the interplay between Euler's identity and the Pythagorean identity. By applying these rules recursively, we generate a dimensional hierarchy in which time, distance, spacetime geometry, Gravity, and momentum arise as natural emergent properties of the expanding polynomial structure.

Within this hierarchy, physical constants and identities emerge such as M and G and e+ ,e- appear as straightforward consequences of the polynomial expansions themselves. We argue that any physical equation can be represented with equal simplicity, implying that the framework has the capacity to model all known physical phenomena purely through its recursive geometric rules.

This paper establishes the foundational structure of the tiered dimensional system and clarifies how physical behavior emerges from it, without making any claims that it replaces or alters the existing laws of physics. Instead, it provides a unified geometric and polynomial model that can reproduce familiar equations and sets the stage for follow-up work deriving experimental results for constants—such as G and α—from the same underlying machinery.

1 Introduction

The goal of this paper is to construct a minimal geometric framework capable of reproducing the full structure of known physics using nothing more than algebraic rules applied recursively. Because this first paper in the series, it attempts to fundamentally connect pure mathematics to pure physics, conceptual arguments for axioms will draw from pure Number Theory and Physics simultaneously. From a mathematical perspective, we do not take the

real number line, or even the natural number line as a given; it must first be constructed. From a Physics perspective, dimensions are not taken as a given, they must be constructed, one at a time. Time must exist before distance, flat spacetime must exist before curved spacetime, 2 dimensions must exists before 3, and consequently one dimension must exist before 2. We impose a small set of rules to achieve this goal, given to us directly by the Euler Identity and Pythagorean Identity, then apply those rules recursively to get polynomial expansions describing each dimension. Finally we equate the polynomial expansions to fundamental physics equations involving time, distance, mass and momentum, G, M, e+,e- and E, conceptually and provide a format for using them to make testable predictions against known physics experiments.

1.1 Motivation

This mathematical framework provides a visual geometric interpretation of physical phenomena. It exists as a series, and therefor as a generative model for physics. It can thus be used to make testable hypotheses about the Physical Universe. It's ability to accurately model the real world allows known physical quantities to be related and compared in previously unrealized ways. This structure can give conceptual meaning to phenomena such as orbitals, spectral lines, electron proton mass relationships, constants like G, and the true source of the experimentally known value for the Fine Structure Constant.

2 The Setup

In order to build a framework capable of generating physical structure from pure algebra, we must begin with the smallest possible assumptions. The approach taken here is to construct dimensionality itself from a single primitive object, and to justify every additional feature like distance, spacetime, mass, momentum, and later electromagnetism and gravity as necessary consequences of the rules imposed at the start.

2.1 Tier 1: Primitive Time and the Binary Foundation

We begin at Tier 1 with a single variable x representing a point. This point exists before a number line, it is a proto 1 dimensional object in its most minimal form. At this level, it can be considered as an infinitesimal with arbitrary size, because without a number line to compare it to, the concept of size has no meaning.

From a physics perspective, this proto 1 dimensional object which exists before a numberline is represented by time, it's value can only be 1 or zero, representing 1 tick of a clock, one indivisable moment of time, the scale of this moment can only be defined later, when other objects exist to compare it against.

From both a mathematics and physics perspective, this pointlike object has no concept of size or scale, however it does have a mathematical form and a physical function.

Tier 1 = $x = e^{\pi i} = 1$ - On State Tier 1 = $x = e^{\pi i}$ -1 = 0 Off State

It is important to mention at this point that using Euler's identity under these dimensional rules gives no access to any number between 0 and 1, no half state may exist, no angle, and none of the reals. The fact that this equation is possible, comes only from the imaginary identity, and the name imaginary in this context is important. It is imagined, because it in fact doesn't exist. Conceptually it can be thought of as; if you were building a number line, and you move off of that numberline into the imaginary dimension, you do not move along the numberline anymore, you cease to exist on that plane.

Therefor, Tier 0 dimension, time, exists only as an on off state, which represents the ticking of a clock.

2.2 Axiom 1: The Addition of the first dimension, Eulers Identity

Any new dimension added must follow the same rule as Tier 1 and be added first as the Euler Identity in an oscillatory state of -1 and 1.

$$x = 1 \text{ or } -1.$$

This is the only dimension with this characteristic and it represents time.

2.3 Axiom 2: Recursive Squaring, Pythagoras Identity

Each new Dimension is obtained by squaring the previous dimension using the Pythagorean relationship

These two simple rules force the identity for Tier 1 to become

$$x^2 + y^2 = 1^2$$

**Conceptual justification of the first expansions: We note that the second axiom expects that tier 1 should be x^2 which would then make Tier 2 x^4 . However, Pythagorean relationship requires 2 separate terms to be related in order to get the third. Therefor this second axiom requires this transformation, which conceptually is valid since the first term was create from purely imaginary properties. Further conceptual arguments are given below, but not required if one accepts the two axioms. Additional conceptual alignment between these ideas are found later in the paper in discussion of the force G and charge.

We earlier stated that Tier 0 has no size, only structure. It is an infinitesimal, therefor it's size cannot be defined using the number line in any way through addition, or multiplication.

The only possible way to give concept of size to an infinitesimal number is through ratio, or relationship. This ratio is given by the Pythagoras identity and it is forced by the Pythagoras relationship. From a Physics perspective, it is easier to make sense of the idea that Time itself could be an infinitesimal. If time was the only thing in the Universe that existed, not even distance itself existed, then there would be no way to measure, rate or compare the flow of time. There would be no change of state, 1000 ticks of the clock in such a Universe gives no concept of the value of each of those individual ticks, it would be impossible to even know if all 1000 ticks of said clock were of equal size, unless you had a second clock to compare them to.

And therefor, for that reason, we jump straight from x to $x^2 + y^2 = 1^2$ This is the method that allows us to build dimensionality, and we use it at every step, where the upcoming dimension, is equal to the 1 from the current dimension. And oscillates at a rate of ^{2} compared to the Dimension before it.

3 Polynomial Expansion of the first 5 Dimensions

Following the strict rules provided by the 2 axioms, we now calculate the first 5 dimensions, we will reserve naming the dimensions until the following sections.

Dimension 1 = $x = 1$

Dimension 2 = $x^2 + y^2 = 1$

Dimension 3 = $x^4 + y^4 + 2x^2y^2 = 1$

Dimension 4 = $(x^8 + y^8) + 6x^4y^4 + (4x^6y^2 + 4x^2y^6) = 1$

Dimension 5 = $(x^{16}+y^{16})+(70x^8y^8)+(8x^{14}y^2+8x^2y^{14})+(28x^{12}y^4+28x^4y^{12})+(56x^{10}y^6+56x^6y^{10}) = 1$

The above 5 dimensions represent the polynomial expansions when squaring the previous tier, with the exception being from 1-2 and 4 which was explained and justified in earlier sections.

These polynomial expansions, although large and unwieldy, can be placed directly into known physics equations, with the correct units in a way that does not alter the current equation.

4 Dimensional Breakdown and Physical alignments

4.1 Dimension 1 = Time

$$x = 1$$

This one is easy, because x = 1 Time = 1 This Geometric structure introduces the idea of absolute time, a ticking of a clock that oscillates between 1 and 0 at a speed which cannot

be resolved in this tier, as it requires being related to other dimensions in order to have meaning. It does however have meaning in the sense of a clock, in that it ticks time. In a Math Framework and Physics framework, this can be thought of as a change of state. Nothing can happen at a faster rate than this clock. This is the definition of Time, before the concept of Planck time, before the concept of quantum effects. In this format, without including spacetime curvature and other effects, Time simply equals whatever unit you are measuring it in fundamental to the Universe itself. Later as we describe further Dimensions and Physical properties, this Time unit will get a unit amount that is relative to Planck time, and will resolve phase relationships and frequencies through its clock speed compared to other dimensions.

4.2 Dimension 2 = Distance or Spacetime or Velocity

$x^2+y^2=1$ This one is still easy to explain in some respects, but it does require a conceptual shift. It is easy from both a Math and Physics perspective to see that this represents Spacetime, because it is of equal parts, and so of course represents flat space. However to call it velocity, from a Physics perspective, is confusing. First, lets consider the equation $Velocity = Distance/Time$ We can see that velocity is of equal parts too. We don't typically think of spacetime as a circle, we think of it as a cube, or on paper, a square, even our graph paper has squares on it.

However that's what this equation suggests. Distance, Spacetime as we know it, can literally be thought of as the Velocity Field. Einstein was able to prove $E = mc^2$ and that equation was accepted to model not just math, but the real physical world. So why shouldn't we allow ourselves to use the equation that literally represents Space and Time as representing our Flat version of spacetime? Einstein Already proved that Gravity itself IS Space time. So this shouldn't be too much of a stretch of the imagination, and the proof of this can only be proven if it is able to accurately model the Univese.

Given that this polynomial equation represents the flat spacetime with which we should measure against. It makes sense that this would be a 1/1 ratio, implying the ability to easily measure your own velocity against this flat Geometric structure. In this sense, you can consider velocity the function which creates Spacetime itself. It is defined by a 1 over 1 ratio of distance to time, in a flat spacetime

4.3 Dimension 3 = Acceleration, Constant G

$$x^4+y^4+2x^2y^2=1$$

This dimension represents both, Gravity and acceleration. It is defined as spacetime curvature, at the level of acceleration. It can be defined without using the concept of mass or gravity. It can be modeled and explained using only Geometry. This should not be too

far of a stretch to imagine, since Spacetime curvature on the planetary scale was already shown to be explained as Gravity. Lets consider for a moment the equation for Acceleration,

$$A = v^2/R \quad \text{-Christiaan Huygens in 1659.}$$

If we fix R in place, and adjust only velocity we can see that acceleration scales with v^2 . If we then remove the R, from the equation since it could have been fixed at 1, the only real scaling factor that mattered was v^2

If you are a physicist, or perhaps even a mathematician, you are screaming right now, that acceleration doesn't work like that. I just transformed a specific form of Acceleration, and declared, it is the only correct form of acceleration. relevant to this equation and the Universe So let me defend that, there are several ways for me to defend that.

First and foremost, we are talking about acceleration in a way that keeps it relevant to explaining the Universe itself, of course we could talk about acceleration of a car down a track and not consider things like relativity, or spacetime curvature, but we are not talking about that here. We are describing acceleration, in terms of the Universe itself. Velocity can only be represented as distance over time, where that orthagonal relationship represents spacetime itself. Similarly, the only proper way to express acceleration, is as a combination of those 2 orthagonal terms. Acceleration must therefor result in a curvature of either space, or time, in order to be represented. This is akin to taking the second derivative, we take the value we have and square it, so that we maintain the orthagonal relationship that originally existed, this gives us two identical copies of what was already an object that had two identical copies. It now allows us to define and measure Acceleration as either : Distance as a curvature of Time, or Time as a curvature of distance, however you prefer to think about it, but it doesn't matter which convention we choose, as long as we remain consistent about it. The mere fact that we can choose to curve in one direction versus the other however, gives us the ability to define an inside and outside curvature in all dimensions. One at a time, by repeatedly applying this Pythagoras Identity of squaring, we create a cycle of defining a Unit, followed by a field made up of that unit, followed by a scalar on that unit, followed by a force of that unit.

That is the source of the 4 cycle system and its conceptual and geometric connection to Unit, Field, Force, New Unit, Or, velocity acceleration jerk snap, Or a 4 cycle system which rotates through 1,0 -1,1

Combining all these properites of mathematics in with the axioms provided by Pythagoras and Euler Gives us all the properties required to define the Universe as we see it, without having to explicitly define a sphere, we do so by defining circles at rotational offsets from eachother. This allows us to model complex topologies exactly as demanded by physics.

I did have 2 more points of proof for that, but I think it is unnecessary.

Acceleration is the force of Gravity itself, it can be literally experienced, as acceleration. On Earth, it is 9.8 meters per second. Acceleration due to gravity is indistinguishable from acceleration due to any other source, a car, or a roller coaster for example. It's the same feeling, its measured in the same units. They are one and the same thing.

So what is the difference between G, and regular acceleration then? G represents perfect curvature, the point where G becomes a perfect circle, that encloses a curvature into a point, that point is defined by $x^4 + y^4 + 2x^2y^2 = 1$ If we now sqaure all of those terms again and repeat the process, we will get the unit of measurement which couples to G to give meaning to the equation F=ma

Therefor this equation does not change standard physics in any way what so ever. All calculations remain the same, both Newtons and GR laws are maintained through this relationship and spacetime curvature.

In later tiers, when Energy and wavelength become important, Einsteins Field Tensors Planck Units, and others are also able to be filled out this way, using the same process.

Einstein derived spacetime curvature from 4-dimensional tensor geometry, while I derive gravity from a 2-variable polynomial expansion tied directly to Huygens' circular acceleration law. Curvature is an algebraic property that emerges from circular motion and polynomial expansion; spacetime curvature is a side-effect, not an assumption.

4.4 Dimension 4 = Mass, inertia, M. e+, e-

$$(x^8 + y^8) + 6x^4y^4 + (4x^6y^2 + 4x^2y^6) = 1$$

This Dimension represents the first dimensional reset in the structure. It also represents the first time a symmetric cross product is created by the contributing factors. That cross product becomes the coupling constant and the boundary layer between the inside and outside of Mass.

By definition of this mathematical structure, the outside layer of that symmetrical term couples with Gravity, There for the inside of this symmetrical term must couple to something else. That something else is momentum we already know this from the identity p = mv

Momentum, and what it couples to, was the key oversight made when the Quantum world was conceptualized.

We now have a bridge to the quantum world, and that bridge is charge.

I will not rehash or rejustify my previous motivation or math framework for doing that, I believe it was explicitly expressed in the Gravity section already.

I will say that, charge represents the unit value. In my 4 cycle system.

We now move onto create Velocity in this Field level

4.5 Dimension 5 = Momentum, electric field, e+,e-

$$(x^{16} + y^{16}) + (70x^8y^8) + (8x^{14}y^2 + 8x^2y^{14}) + (28x^{12}y^4 + 28x^4y^{12}) + (56x^{10}y^6 + 56x^6y^{10})$$

In the last tier, electric charge acted as a point like particle with euler Identity, in this Tier, the Electron is now representing a field created by velocity. Since it's velocity is spinning around a circle, that automatically requires acceleration and therefor generates force.

That force is the static electric field. This equation therefor describes the fields shape, size and strength simultaneously. The reason the Electric field is a stable force, is because it's velocity around the circle it traces is also stable.

The reason that the mass of an electron cannot be resolved to a point, is because it exists only as a spacetime curvature, not as a thing, not like a tiny apple rotating around a central point. It does have a space in which it exists however, and the shape of that space, at low energy is exactly this equation. This should coincide with Niels Bohr's electron radius but I leave the calculation of that for another paper. (GR level effects will be applied in subsequent tiers which will affect this radius from our point of measurement)

So far every step to get here, has just been squaring the previous. velocity, was distance squared (or time squared its irrelevant how you look at that.)

Acceleration, was Velocity Squared Mass was Acceleration Squared And now Momentum = Mass Squared

At this level of resolution, the static field produces no force inside of its own velocity space. However, from our macroscopic view in comparison, we view that as a field with a combined force, known as the electric force, as it represents constant velocity around a circle, relative to us.

Physics took a wrong turn when they described the quantum world without having an equation to conserve the momentum of an electron. They developed axioms to prove that they were right, and built on top of them.

This equation defines the size of an electron with rest Energy, it has intrinsic momentum, velocity and acceleration, but no added acceleration in its own field yet, from an electrons point of view, in this state, it is travelling in a straight line. Only in our external view do we perceive its velocity to be curved.

We now move onto create acceleration in this Field level

4.6 Dimension 6 = Magnetic Force, B, couples to +-e, E

$(x^{32} + y^{32}) + 16(x^{30}y^2 + x^2y^{30}) + 120(x^{28}y^4 + x^4y^{28}) + 560(x^{26}y^6 + x^6y^{28}) + 1820(x^{24}y^8 + x^8y^{24}) + 4368(x^{22}y^{10} + x^{10}y^{22}) + 8008(x^{20}y^{12} + x^{12}y^{20}) + 11440(x^{18}y^{14} + x^{14}y^{18}) + 12870x^{16}y^{16}$

I first need to clarify and differentiate: I understand that an Electric field produces a magnetic field when given velocity. What I am saying here, is that in it's own state, it's own miniature version of spacetime, it is traveling in a straight line with a constant velocity in

the **previous** tier.

In this tier, it is now gaining acceleration in it's own version of space time, and this acceleration generates a force, which we understand to be Magnetic force.

This geometric method of measurement relies on no sense of units, and expresses everything as pure ratios, of rotations defining a circular field, therefor units can be assigned to them, according to their properties as required in order to take measurement as desired.

This is why in our own frame of reference, when giving electric charge a velocity, it produce magnetic force. It is the process of giving The Static Field an acceleration in it's own tier level.

And since, the magnetic field has its own coupling event on the opposite side, giving an elecdtric field an acceleration in our frame, raises it up a second level, and that level represents Photon Energy.

From this point on, the pattern should be established and enough equations formally linked that the path forward is testable and clear. Dimension 7 represents the next unit, Energy, as a photon. Further connections between this geometric structure and things like Hbar should know be able to be formally linked into this table through it's various identities involving charge, mass, and frequency.

We leave it to the reader, or for a future paper of our own to make those formal connections.

We fully expect that using this same framework, all physics models can be accurately modeled, QFT, QCD, these frameworks should now be able to be formally linked into this Geometric expression in a way that is elucidating, meaningful and helpful, through connections to this Geometric progression such as : $m_{\mathrm{P}} = \sqrt{\frac{\hbar c}{G}} \quad F = G\frac{m_1 m_2}{r^2} \quad g(r) = G\frac{M}{r^2}$

Further we now have a bridge for the connection between forces, so that all forces can be describes as accleration, or curvature of a flat velocity field, to some power N And use a generalized Term for force applicable to all fields and forces.

$$Force = \text{ velocity squared } /r$$

The motivation for the addition of new dimensions using this format was first driven by noticing that all forces seemed to be related through time. As I began working on the geometric expression, I saw symmetries between physical concepts and mathematical. Number Theory concepts and Physics concepts acted as a feedback loop to come to these conclusions.

5 Discussion

The framework developed here is intentionally minimalistic. By restricting the axioms to (1) Euler-type oscillatory initialization, (2) recursive squaring via the Pythagorean identity, and (3) a repeating four-step cycle of scalar–velocity–acceleration–jerk, the resulting structure produces a hierarchy that resembles physical behavior without requiring external assumptions such as predefined units, dimensions, or coordinate systems.

A central philosophical point is that the polynomial tiers do not encode *units*; they encode *ratios*. Any physical equation built purely from ratios remains valid under unit reassignment, and the framework deliberately exploits this fact. Mass, distance, charge, curvature, and field strength appear as relational quantities, not as objects requiring an external metric. This addresses the most common objection, namely that physics requires units by showing that the internal structure of the tiers reproduces the same algebraic forms that normally arise only after units have already been chosen.

Several conceptual correspondences emerged naturally: Tier 2 behaves as flat spacetime or velocity; Tier 3 introduces irreducible mixed curvature, matching the functional role of mass and gravitational acceleration; Tier 4 resets the scale and generates a charge-like coupling; Tier 5 exhibits the algebraic structure characteristic of a static electric field. None of these identifications were imposed; they were consequences of the polynomial rules.

The framework does not claim to supersede existing physical theories. Instead, it suggests that many familiar laws of physics may share a deeper algebraic origin, one that does not explicitly depend on geometry, tensors, or quantization. If the structure truly underlies constants such as G or α, then those constants should be recoverable from the tier transitions alone. Verifying this is the natural next step.

6 Conclusion

This first paper establishes the core machinery of the tiered polynomial framework and demonstrates that recognizable physical structure emerges from purely algebraic recursion. The approach reframes dimensions, fields, and coupling constants as consequences of iterated curvature rather than primitive assumptions.

Future work will focus on deriving measurable constants including the fine structure constant, the gravitational constant, and particle mass ratios from the tier geometry, as well as studying how higher tiers encode magnetic structure, spin, and quantum behavior. If these connections hold, the framework may offer a unified algebraic origin for both classical and quantum phenomena.

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