Proof of Goldbach's Conjecture and Addendums

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04/05/2018

Discussion included in Goldbach Analysis

Update 04/06/2018: Clarification and addition of Summary

Update 04/07/2018 15:19 Re written with example

04:/08/2018 16:45 Multiple updates, bugs squashed, hopefully clearer

04/09/2018 Addendum included

04/11/2018 7:54 am Edited and revised for clarity.

04/11/2018 11:20 Addendum Included

04/12/2018 06:52 Addendum showing geometric relation in terms of areas (energies) characterized by prime numbers.

04/12/2018 12:53 Added geometric diagrams showing geometric relation in terms of areas (energies) characterized by prime numbers.

The equation to be addressed is:

$\left[\left(c\tau\right)_x\right]^2+\left[\left(v\tau'\right)_y\right]^2=2\left(c\tau\right)_x\left(v\tau'\right)_y$, where the distinction between the operations of addition in the sum of squares is indicated in red, and that of multiplication in blue, and where each of its components are prime numbers:

$p_x{}^2+p_y{}^2=2p_xp_y$ so that $p_x+p_y=2p_xp_y$

|---| 30
|--------- $p_1=23$------------------------------|----$p_2=7$--------| 23+7
|----------$p_1p_2=3*5$---------------|----------$p_1p_2=3*5$---------| $2(3)(5)$

Not that the length $L=30$ is in terms of particle count (prime number count) which are function such

$$f(\{c,t\},\{v,t'\})=2g(\{c,t\},\{v,t'\})$$
$$f(\{ct\},\{vt'\})=2g(\{ct\},\{vt'\})$$

So that

$$(p_1(c\tau)+p_2(v\tau')=2\left[p_1(ct)\right]\left[p_1(vt')\right]$$
$$L=L\left[(c,\tau),(v\tau')\right]=L=L\left[(c,\tau),(v\tau')\right]$$

$$(c\tau)^2+(v\tau')^2=2(c\tau)(v\tau')$$
$$2\log(c\tau)+2\log(v\tau')=2\log\left[(c\tau)(v\tau')\right]$$
$$\log(c\tau)+\log(v\tau')=\log\left[(c\tau)(v\tau')\right]$$

The variables $\{\{\tau,\tau'\},\{\tau,\tau'\}\}$ can now be set to

$1_{c\tau}=\log_{c\tau}(c\tau), 1_{v\tau'}=\log_{v\tau'}(v\tau'), 1_{c\tau}=\log_{c\tau}(c\tau)$ and $1_{v\tau'}=\log_{v\tau'}(v\tau')$,

so that

$\log(c)+\log(v)=\log\left[(c)(v)\right]$, $2\log(c)+2\log(v)=2\log\left[(c)(v)\right]$.

Therefore, $(c)^2+(v)^2=2(c)(v)$.

$2(c)(v)$ is an even real number, and $(c)^2+(v)^2$ is the sum of two primes; the sets $\{\{c\},\{\tau\},\{v\},\{\tau'\}\}$ are each complete in real numbers, where the prime numbers are defined in terms of the equation and the scaling of each product in their respective domains; setting the variables $\{\tau,\tau',\tau,\tau'\}=\{1,1',1,1'\}$ results in the four prime numbers $\{c,v,c,v\}$ that satisfy

$$(c)^2+(v)^2=2(c)(v)$$

Therefore, every real number is the sum of two primes.

QED

There are four equations in four unknowns in terms of primes; in terms of the equation to be addressed, there are eight equations in eight unknowns.

As an example, for $p_x{}^2=23$, $p_y{}^2=7$, $p_x=3$, and $p_y=5$

$$23+7=2(3)(5)=30$$

$$[p_x]^2 = \left[\sqrt{23}\right]^2 = \left[(c)_x\right]^2 = (c_x)^2 = 23$$
$$\left[p_y\right]^2 = \left[\sqrt{7}\right]^2 = \left[(v)_y\right]^2 = (v_y)^2 = 7$$
$$[p_x] = \left[\sqrt{3}\right]^2 = (c_x) = 3$$
$$\left[p_y\right] = \left[\sqrt{5}\right]^2 = (v_y) = 5$$

$$23(\tau)^2 + 7(\tau')^2 = 2(3\tau)(5\tau')$$

There are four equations in four unknowns given that one already knows the prime numbers, in terms of $\left\{\left\{\tau^2,(\tau')^2\right\},\{\tau,\tau'\}\right\} = \left\{\left\{1^2,1^2\right\},\{1,1\}\right\}$. If this is sufficient, then the equation becomes $c^2 + v^2 = 2cv$ where each element of $\left\{\left\{1^2,1^2\right\},\{1,1\}\right\}$ is a unit or unit squared basis for the partition.

However, the log of a prime number to its base is prime as the basis of a dimension characterized by its radix, where $1_p = \log_p(p)^1 = \log_p(p)$

$$(\tau)^2 = 1_{\left(\sqrt{23}\right)^2} = \log_{\left(\sqrt{23}\right)^2}\left[\left(\sqrt{23}\right)^2\right]^1 \Rightarrow 23 = (23)1_{\left(\sqrt{23}\right)^2} = 23\tau^2 = (c\tau)^2$$
$$(\tau')^2 = 1_{\left(\sqrt{7}\right)^2} = \log_{\left(\sqrt{7}\right)^2}\left[\left(\sqrt{7}\right)^2\right]^1 \Rightarrow 7 = (7)1_{\left(\sqrt{7}\right)^2} = 7\tau'^2 = (v\tau')^2$$
$$\tau = 1_3 = \log_{(3)}(3) \Rightarrow 3 = (3)1_3 = 3\tau = c\tau$$
$$\tau' = 1_5 = \log_{(5)}(5) \Rightarrow 5 = (5)1_3 = 5\tau = v\tau'$$

and

$$1_{\left(\sqrt{23}\right)^2} + 1_{\left(\sqrt{7}\right)^2} = 2(1_3)(1_5),$$

Where 1_{23}, $1_7, 1_3$, and 1_5 are all prime (can only be divided by themselves.

The equation then becomes

$\left[(23)\left(1_{\left(\sqrt{23}\right)^2}\right)\right] + \left[7\left(1_{\left(\sqrt{7}\right)^2}\right)\right] = 2\left[(3)(1_3)\right]\left[(5)(1_5)\right] = 30$ where each prime is represented by the basis of its own logarithm, and so is unique in its partitioning of the length $L = 30$ in terms of units unique to each prime number.

That is, $(c\tau)^2 + (v\tau')^2 = 2(c\tau)(v\tau') = L = 30$ where L is the unit count (length in units) of the total number of units, $c^2 = 23$, $\tau^2 = 1_{(\sqrt{23})^2}$, $v^2 = 7$, and $(\tau')^2 = 1_{(\sqrt{7})^2}$ under the Addition operation, and $c = 3$, $\tau = 1_3$, $v = 5$, and $\tau' = 1_5$ under the Multiplication operation, so that the operations partition the common length of 30 units differently. These partitions are unique because of the sum of squares equality to the multiplication operation, because the length is countable on both sides of the equality.

Addendum

$$c^2 + v^2 = 2vc$$

If there are common prime numbers k, they can be divided out:

$$c^2k^2 + v^2k^2 = 2(vk)(ck) = 2vck^2 = c^2 + v^2 = 2vc$$

So $c^2 + v^2 = 2vc$ as before.

Let $v = c$ and $v = c$ so that

$$c^2 + c^2 = 2c^2$$

$$c^2(1^2 + 1^2) = 2c^2(1^2)$$

$$2c^2(1^2) = 2c^2(1^2)$$

$$c^2 = c^2$$

Setting $c = c = c$ results in

$$(1^2 + 1^2) = 2(1^2)$$

Relativistic energies are equal on both sides for particles of unit mass under addition and multiplication

Summary

The sets $\{\{c\tau\},\{v\tau'\}\}$ and $\{\{c\tau\},\{v\tau'\}\}$ of positive real numbers where

$\{c,\tau,v,\tau',c,\tau,v,\tau'\}\in\{\mathbb{R}\}$

is complete under addition and subtraction.

Prime numbers are defined by removing the operation of division, distribution and associative laws under addition and multiplication and parameterizing the Binomial Expansion; the set is complete and countable under both addition and multiplication. The creation of the complete subset of prime numbers in terms of real numbers is accomplished by setting $(c\tau')^2 = 0$ in the equation $(c\tau')^2 = (c\tau - v\tau')^2 = (v\tau')^2 + (c\tau)^2 - 2(c\tau)(v\tau')$, so that $(c\tau)^2 + (v\tau')^2 = 2(c\tau)(v\tau')$ where the subsets $\left[\{p_x, p_y\},\{\{p_x\},\{p_y\}\}\right]$ and are independent under the operations of addition and multiplication, respectively. The prime numbers $\left[\{p_x, p_y\},\{\{p_x\},\{p_y\}\}\right]$ then are characterized by the bases $1_p = \log_p(p)$ and under the operation of addition and $1 = \log_p(p)$ and $1 = \log_p(p)$ under the operation of multiplication, so the bases are unique under the radixes of their respective subsets, and characterize the set of all real numbers without division (or subtraction). The bases for the complete sets in terms of their radixes is then $\left[\{\{1_c\},\{1'_v\}\},\{\{1_c\},\{1'_v\}\}\right]$ which is characterized by $\{1_c\}+\{1_v\} = 2\{1_c\}\{1_v\}$.

Therefore every even number $2\{c\cdot 1_c\}\{v\cdot 1_v\}$ is equal to the sum of two primes $\{c^2\cdot 1_{c^2}\}+\{v^2 1_{v^2}\}$, since if p is prime, then so is p^n and $p^{\frac{1}{n}}$, and in particular p^2 and $p^{\frac{1}{2}} = \sqrt{p}$.

QED

Note: This approach can be expanded two multiple sets of prime numbers by the Multinomial Expansion as an extension of the Binomial Expansion by further parametrization; however, that is outside the scope of this proof.

Example:

$$\left(\sqrt{p_x}\right)^2 = (c\tau)^2$$
$$\left(\sqrt{p_y}\right)^2 = (v\tau')^2$$

$\left(\sqrt{p_x}\right)^2 + \left(\sqrt{p_y}\right)^2 = p_x + p_y$ is the sum of two primes; therefore $(c\tau)^2 + (v\tau')^2$ is the sum of two primes.

$$p_x = c\tau$$
$$p_y = v\tau'$$

$(c\tau)^2 + (v\tau')^2 = 2(c\tau)(v\tau')$, where $2(c\tau)(v\tau')$ is an even product of two prime numbers and $(c\tau)^2 + (v\tau')^2$ is the sum of two prime numbers and the count of set elements under addition is equal to the count of set elements under multiplication.

Therefore, every even product of two prime numbers is equal to the sum of two prime numbers.

Example:

$$p_x = 23 = (c\tau)^2,\ p_y = 7 = (v\tau')^2$$
$$p_x = 5,\ p_y = 3$$
$$p_x + p_y = 2(p_x p_y)$$
$$(c\tau)^2 + (v\tau')^2 = 2(c\tau)(v\tau')$$
$$23 + 7 = 2(3)(5) = 30$$

QED

Example: $23 + 7 = 2(3 \cdot 5) = 30$

$$c_x = 23, \ p_x = (23)^{\frac{1}{2}}$$

$$c_x = \left[(23)^{\frac{1}{2}}\right]^2 \Rightarrow (p_x)^2 = 23$$

$$\tau_x = 1_x = \ln\left[\exp(23)\right]^1$$

$$(p_x)^2 \tau_x = 23(1_x) = c_x \tau_x = 23$$

$$v = 7, \ p_y = (7)^{\frac{1}{2}}$$

$$v_y = \left[(7)^{\frac{1}{2}}\right]^2 \Rightarrow (p_y)^2 = 7$$

$$\tau'_y = 1_y = \ln\left[\exp(7)\right]^1$$

$$(p_y)^2 \tau'_y = 7(1_x) = v_y \tau'_y = 7$$

$$c_x \tau_x + (v_y)(\tau'_y) = 23 + 7 = 30$$

$$c\tau + v\tau' = 30$$

$$c_x = 5, \ p_x = (5)^{\frac{1}{2}}$$

$$c_x = \left[(5)^{\frac{1}{2}}\right]^2 \Rightarrow (p_x)^2 = 5$$

$$\tau_x = 1_x = \ln\left[\exp(5)\right]^1$$

$$(p_x)^2 \tau_x = 5(1_x) = c_x \tau_x = 5$$

$$v_y = 3, \ p_y = (3)^{\frac{1}{2}}$$

$$v_y = \left[(3)^{\frac{1}{2}}\right]^2 \Rightarrow (p_y)^2 = 3$$

$$\tau'_y = 1_y = \ln\left[\exp(5)\right]^1$$

$$(p_y)^2 \tau'_y = 5(1_y) = v_y \tau'_y = 3$$

$$2(c_x \tau_x)(v_y \tau'_y) = 2(5)(3) = 2(15) = 30$$

$$2(c\tau)(v\tau') = 30$$

Again, τ_x and τ'_y are in the same additive "dimension" ; τ_x and τ'_y are in the same multiplicative "dimension" and both are units in the same "prime number" dimension as independent subsets (vector addition and multiplication does not apply if there is no resultant). So in the above example with prime numbers as the “coefficients” of their radix “bases”, the result is

$(23)\tau_x + (7)\tau'_y = 2(5\tau_x)(3\tau'_y)$ so that $30 = 30$, with all values taking place in the same number system (along the same “geodesic”)

Addendum

Let $(c\tau)$ and $(v\tau')$ be independent elements over the positive real numbers $\{\{c,\tau\},\{v,\tau'\}\}$ and the relation between them characterized as a single valued function of both sets, where each set of pairs runs over the real numbers.

(The Binomial Expansion In general expresses interactions but preserves widget count in is constituent variables. As such, its operators are different from arithmetic and vector operations.)

The Elements are added

$$c\tau' = c\tau + v\tau'$$
$$(c\tau')^2 = \left[(c\tau)+(v\tau')\right]^2 = (c\tau)^2 + (v\tau')^2 + 2(c\tau)(v\tau')$$

(This is the foundation for my proof of Fermat's Theorem in terms of the Binomial Expansion for $n > 2$) .

$$c\tau' = c\tau + v\tau'$$
$$(c\tau')^n = \left[(c\tau)+(v\tau')\right]^n = (c\tau)^n + (v\tau')^n + rem(c\tau, v\tau', n)$$

This can be expanded in any number of ways

$$(c\tau')^n = \left[(c\tau)+(v\tau')+(c\tau)+(v\tau')\right]^n = \left[(c\tau)^n + (v\tau')^n\right] + \left[(c\tau)^n + (v\tau')^n\right] + rem(c\tau, v\tau', c\tau, v\tau', n)$$

(etc.)

The Elements are subtracted

$$c\tau' = c\tau - v\tau'$$
$$(c\tau')^2 = \left[(c\tau)-(v\tau')\right]^2 = (c\tau)^2 + (v\tau')^2 - 2(c\tau)(v\tau') = (\mathrm{CT})^2 + (\mathrm{VT}')^2$$

This is the foundation of classical quantum mechanics and (linear) STR, where the "spin" interaction $-2(c\tau)(v\tau')$ is ignored.

The Elements are added, but there is no resultant

$$c\tau' = c\tau + v\tau'$$
$$0^2 = (c\tau')^2 = \left[(c\tau)+(v\tau')\right]^2 = (c\tau)^2 + (v\tau')^2 + 2(c\tau)(v\tau')$$
$$(c\tau)^2 + (v\tau')^2 = -\left[2(c\tau)(v\tau')\right]$$

“Nothing there” at the beginning; the equation is only valid for $(c\tau)=(v\tau')=(c\tau)=(v\tau')=0$

This is the equation of the “Big Bang” and the Russell Paradox; an unbounded result starting from nothing. The “moment” something exists, then the resultant appears on the lhs.

The Elements are subtracted, but there is no resultant

$$c\tau' = c\tau - v\tau'$$
$$0^2 = (c\tau')^2 = \left[(c\tau)-(v\tau')\right]^2 = (c\tau)^2 + (v\tau')^2 - 2(c\tau)(v\tau')$$
$$(c\tau)^2 + (v\tau')^2 = \left[2(c\tau)(v\tau')\right]$$

This is the definition of prime numbers: Goldbach’s conjecture satisfied for $\tau=\tau'=\tau=\tau'=1$

Addendum (Coordinate relationships)

Cartesian

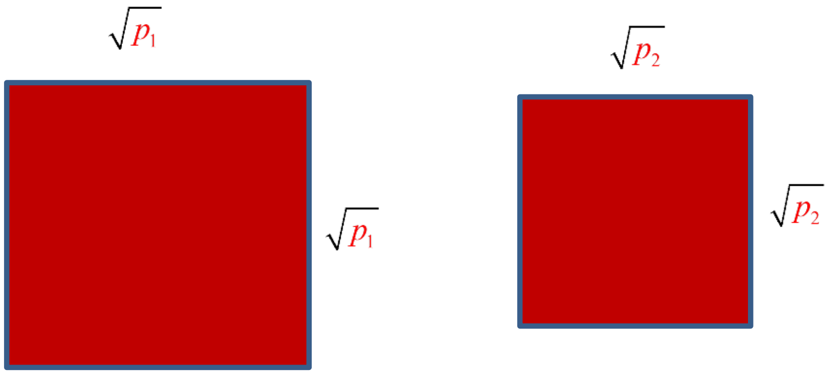
The equation $v^2+c^2=2vc$ can be characterized as a relation between areas (energies) in Cartesian coordinates, where the area on the ri.h.s. is related to the four quadrants of the relativistic unit circle by

$2vc = 4(\frac{1}{2}vc) = 4A_{\triangle} = 2(p_v p_c)$ where each parameter characterizes integers on the c and v axes on the rhs, and is equivalent to a square of with area $A_{\square}$

$$A_{\square} = v^2 + c^2 = s^2 = \left(\sqrt{v^2+c^2}\right)^2 = \left(\sqrt{A_v^{\,2}+A_c^{\,2}}\right)^2 = \left(\sqrt{p_v^{\,2}+p_c^{\,2}}\right)^2 = p_v^{\,2}+p_c^{\,2}$$,and

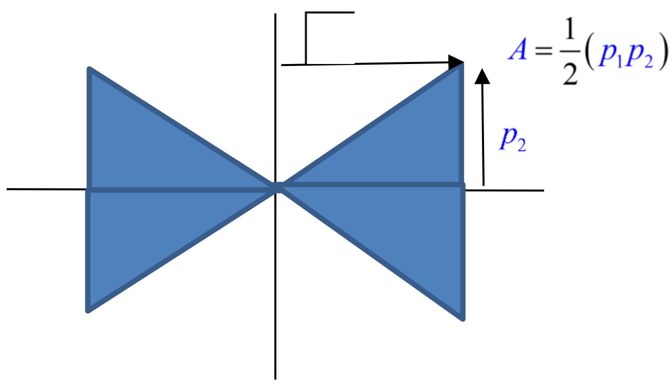
$$A_{\square} = \left(\sqrt{p_v^{\,2}+p_c^{\,2}}\right)^2 = p_v^{\,2}+p_c^{\,2} = 4A_{\triangle} = 2(p_v p_c)$$

which relates the areas to the areas of the four quadrants of the inscribed triangles in the RUC of the in terms of prime numbers.



$A_1 = \left(\sqrt{p_1}\right)^2 = p_1 = \left(c\tau\right)^2$ $A_2 = \left(\sqrt{p_2}\right)^2 = p_2 = \left(v\tau'\right)^2$

$$A = p_1 + p_2 = A_1 + A_2$$



$$A = 4\left(\frac{1}{2} p_1 p_2\right) = 2\left(p_1 p_2\right)$$

$$A = A$$

$$p_1 + p_2 = 2\left(p_1 p_2\right)$$

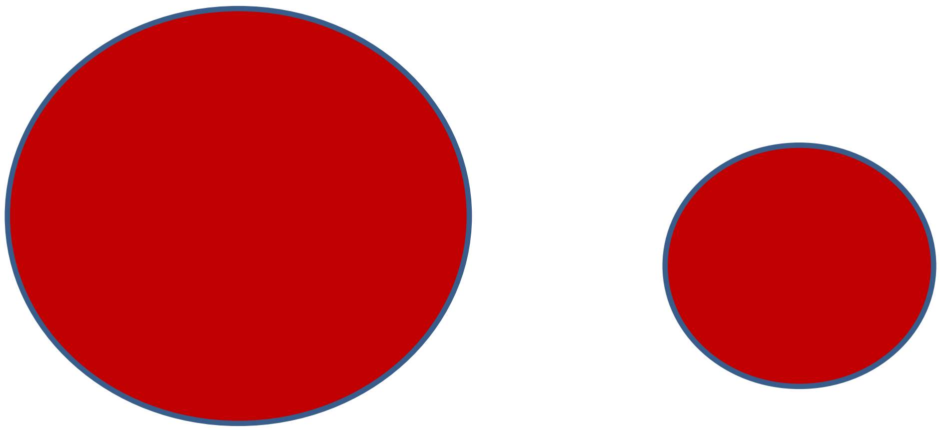
Polar Coordinates

In polar coordinates, the equation becomes $\pi\left(v^2+c^2\right)=2\pi\left(vc\right)$ so that

$\pi\left(v^2+c^2\right)=\pi r^2=A_{\circ}=\pi\sqrt{\left(v^2+c^2\right)}^2=2\pi\left(vc\right)=2\pi r=C_{\circ}$ where

$A_{\circ}=\pi\sqrt{\left(p_y{}^2+p_x{}^2\right)}^2=\pi\left(p_y{}^2+p_x{}^2\right)$ and $C_{\circ}=2\pi\left(vc\right)=2\pi r$ are the area and the circumference

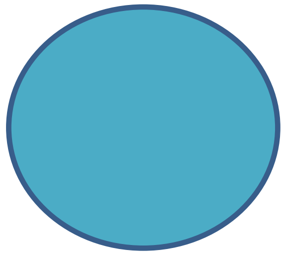
of the prime circles expressed in prime numbers



$$r_1=\sqrt{p_1} \qquad r_2=\sqrt{p_2}$$

$$A_1=\pi\left(r_1\right)^2=\pi p_1 \qquad A_2=\pi\left(r_2\right)^2=\pi p_2$$

$$A=A_1+A_2=\pi\left(p_1+p_2\right)=\pi\left[\left(c\tau\right)^2+\left(v\tau'\right)^2\right]=\pi\left(r_1^2+r_2{}^2\right)$$



$$r = p_1 p_2 = (c\tau)(v\tau') = A$$

$$C = 2\pi r = 2$$

$$\pi p_1 p_2 = 2\pi(c\tau)(v\tau') = 2\pi A$$

$$A = \frac{C}{2\pi}$$

$$A = \pi\left(r_1^2 + r_2^2\right) = \pi R^2, \Leftrightarrow R^2 = \left(r_1^2 + r_2^2\right)$$

$$A = \pi(p_1 + p_2) = 2\pi A$$

$$p_1 + p_2 = 2A = 2(p_1 p_2) = L$$