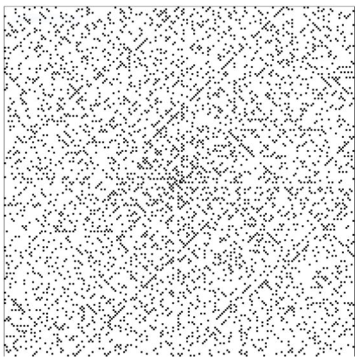
SQUARE POSITIONAL SYSTEM

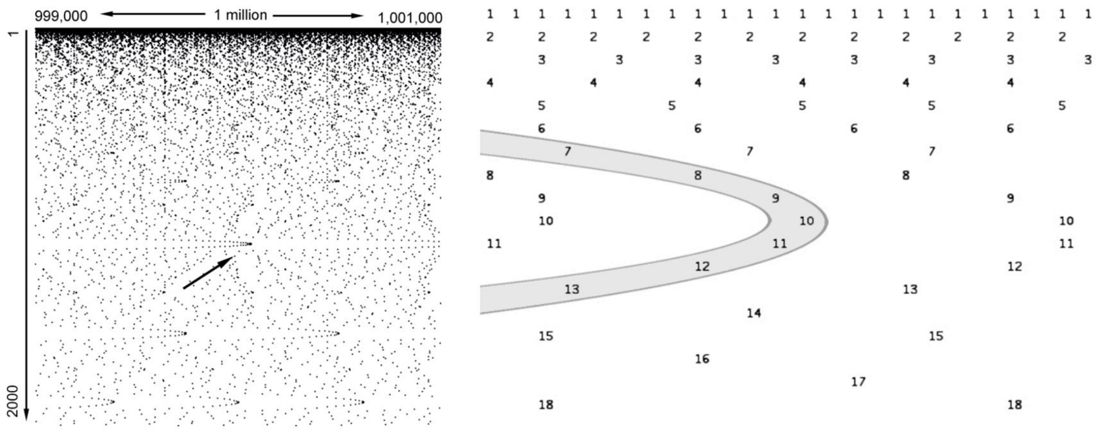
„The Pythagoreans perceived the Universe as a harmony of opposites such as limited and limitless even and odd masculine and feminine etc. The source of all of them is the unknowable One. Sometimes this One was identified with a monotheistically understood God." Wikipedia about Pythagoreans

This document is the result of the author's research for an answer to the question: Is there a common background between a physicist and a mathematician in the form of a universal number system observable in nature. How much mathematics is reflected in nature? This is how the concept of the square numer system was created.

The fascination with the issues related to prime numbers did not bypass the author as well prompting him to do his own research. Seeing the mathematician's struggles. I asked a question: Is the positional mathematical system ordering natural numbers according to an arbitrary constant (e.g. 10 12 60 ...) able to bring us closer to solving the problem of randomness of prime numbers? Looking at physics we noticed that interactions always occur between two objects which are the result of previous interactions. Everything is in mutual relation to each other. Electromagnetic radiation and gravity are governed by the inverse square law. Could this be a reason for mathematicians to search further?
The mathematician Stanisaw Ulam in the form of the famous Ulam spiral presented a visual representation of the set of natural numbers along with the distribution of the prime numbers marked with a gradient. Source Wikipedia



Speaking of primes it is also necessary to mention the multiples of prime numbers which effectively determine the unpredictable nature of successive prime numbers. Mr. Krzysztof Malanka in a scientific article A„Analytical Representations of Divisor of Integers CMT 23(2) 85-91 (2017) explained the formation of parabolic structures between divisors and multiples of natural numbers. This phenomenon was previously noticed and presented in the book by J.J. Ventrella Divisor Drips and Square Root Waves-Prime Numbers are the Holes in Complex Composite Number Patterns www.divisorplot.com. However the above discovery did not find practical application probably due to the still irregular nature of parabolic patterns of divisors.

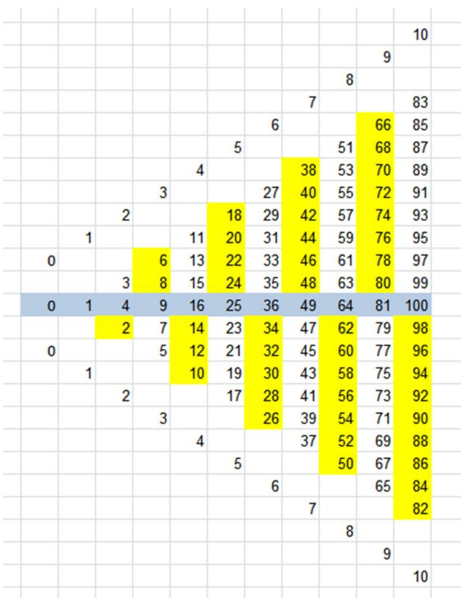


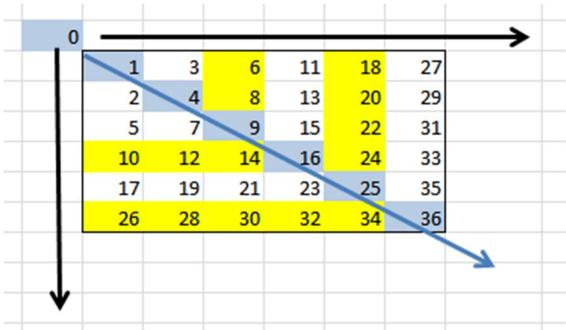
Source: Divisor Drips and Square Root Waves – Prime Numbers are the Holes in Complex Composite Number Patterns J.J. Ventrella

Following the earlier thoughts the author of this publication proposed that the basic reference point in the set of natural numbers should be axis of squares a number with a rational root where the result of the square root is always a whole number. Even and odd numbers shall be written symmetrically with respect to the square axis. Additionally the columns of even and odd numbers must be commutative to each other. Number values are represented in decimal notation.

The author associates this way of arranging natural numbers with the induction of an electromagnetic wave. Wherealternating and different magnetic and electric components form a tandem in the form of an electromagnetic wave in a state of internal dynamic equilibrium. The hidden point of support and rotation in the square axis determines the energy the height of the columns.

„One image is worth more than a thousand words"





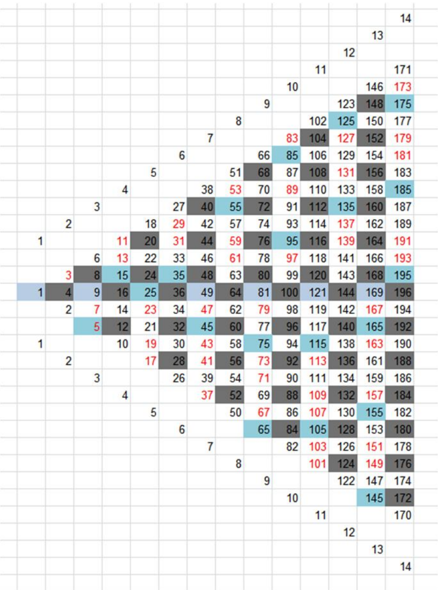
The above system of numbers can also be presented in the form of a square - the picture on the right. However this will disturb the symmetries and parabolic images of odd divisors. The value of zero has been presented somewhat outside the square of the powers. Although it is on the square axis it represents the support point for all divisor periods. Using this notation a Square Positional Number System was created and expands in three directions. Each number is assigned not only to the axis of the squares i.e. the column in which the given number appears but also to the distance from the axis of the squares creating a two-dimensional positional system.

Divisors of numbers and formulas in divisor periods

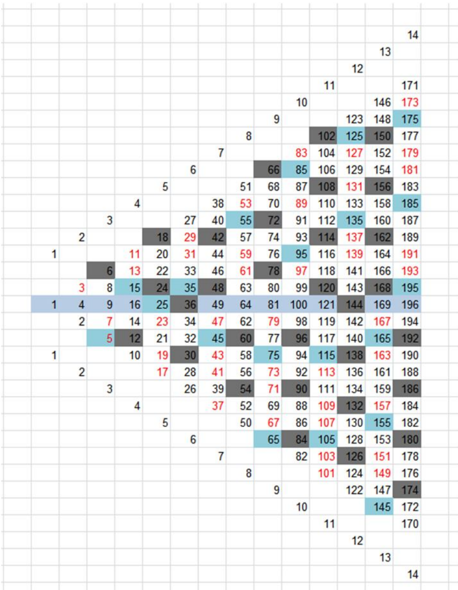
The advantage of the new system is the ability to easily determine the image of the divisor periods of numbers and their position in the set of natural numbers. Factorization of complex numbers is a simple comparison (addition or subtraction). It is like walking up stairs.

The periods of even divisors create cyclic and symmetrical patterns consisting of evenly distributed multiples of numbers. The height is placed in the square of the table of numbers with the side of the given divisor. Even divisors appear only in columns of even numbers creating regularly repelling boxes. Marked in the drawings in dark graphite. Numbers divisible by 5 are marked in bluish color. Numbers with red font color are prime numbers.

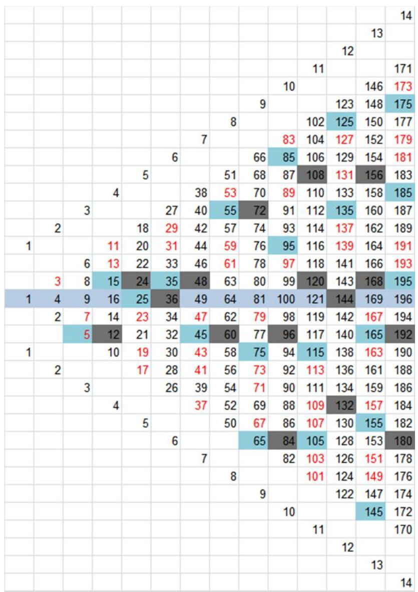
Divisor 4



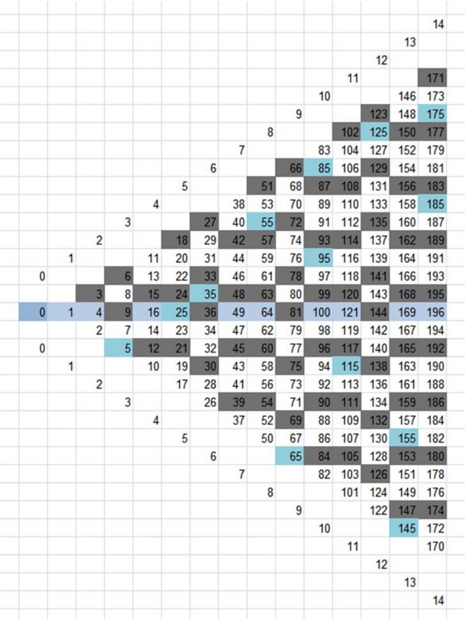
Divisor 6



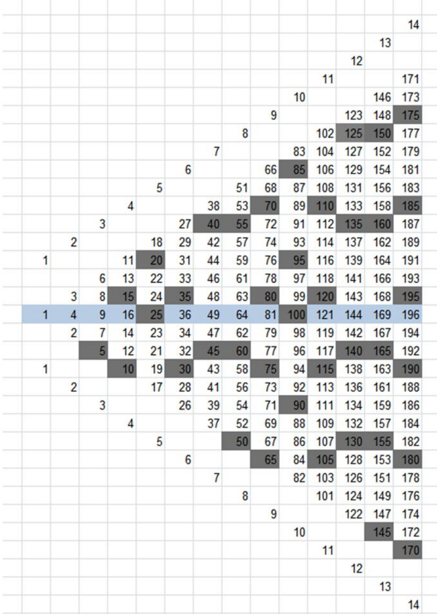
Divisor 12



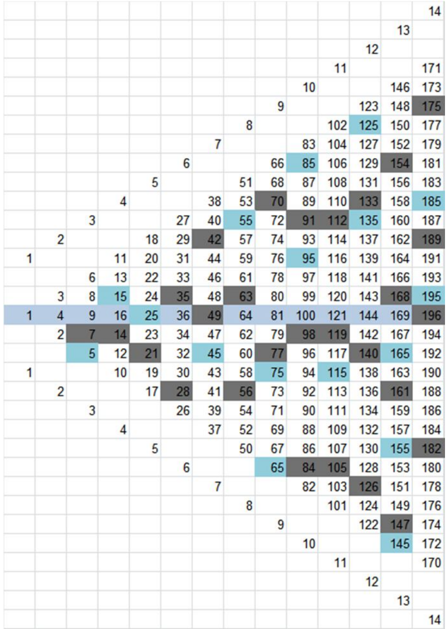
Divisor 3



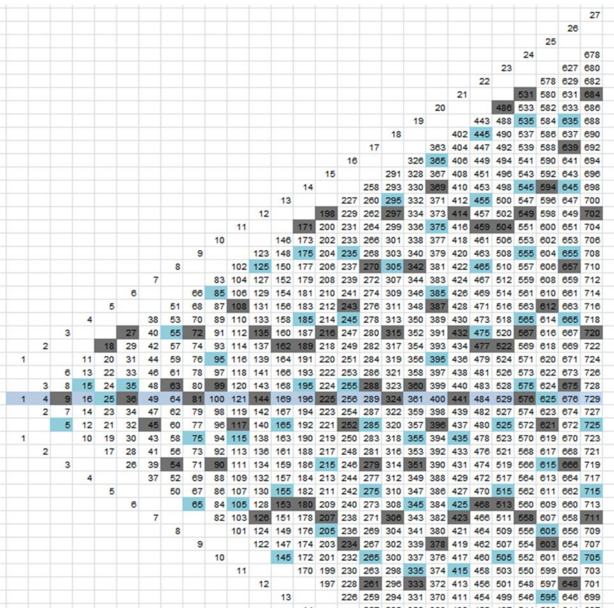
Divisor 5



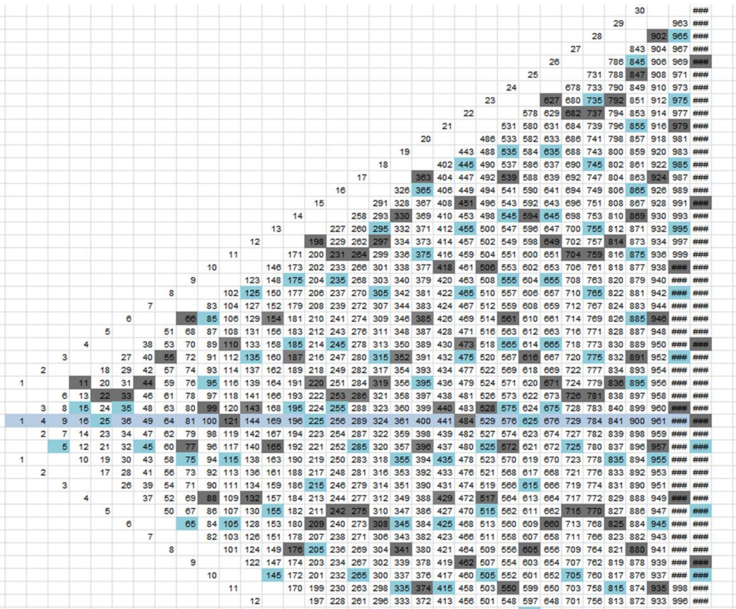
Divisor 7



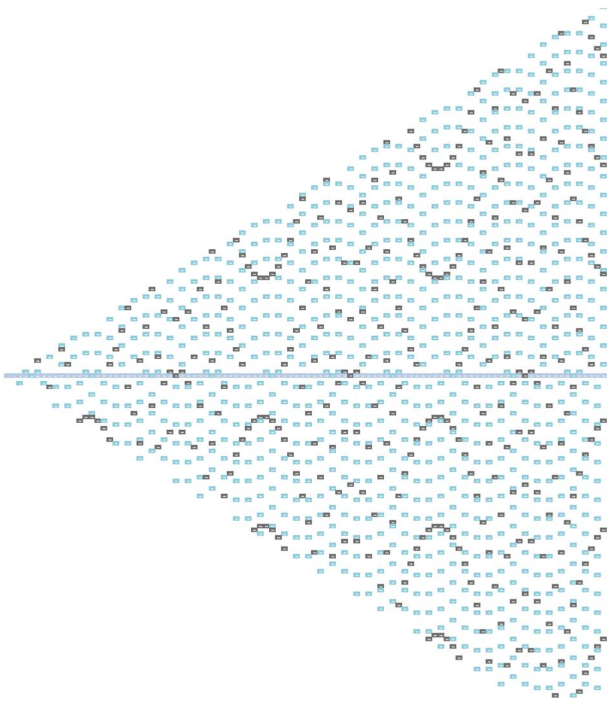
Divisor 9



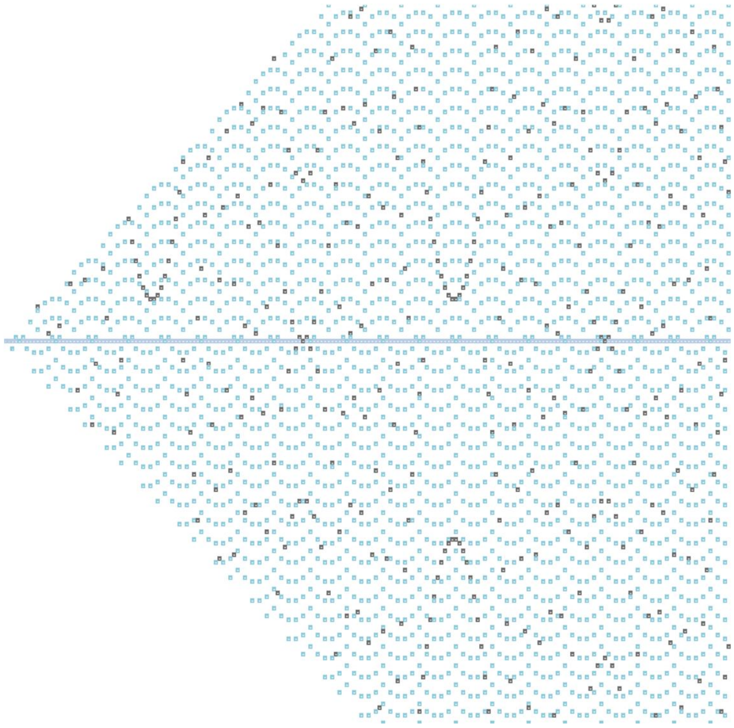
Divisor 11



Divisor 29



Divisor 89

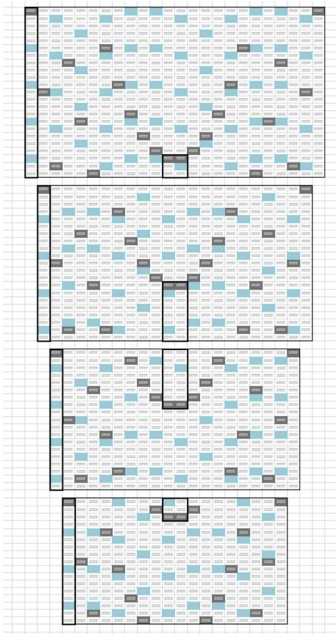


Divisor quartets

By looking at parabolic formulas we can group odd divisors into 4 types creating quartet. Knowledge of the existence of quartets of divisors is necessary in order to determine the position of the apex of a parabola. This is necessary for the factorization process of complex numbers. With each successive quartet the number of periods of a given divisor increases which is needed to create a complete picture of a parabola from the tip to the end of the arm the first row in the period. Below is a table of quartets and a comparison of the periods of divisors 17 19 21 23 belonging to a common quartet. It can be noticed the falling tip of the parabola towards the end of the period. Note that the selected column to the left of the divisor period is also a common column for the next repeating divisor cycle.

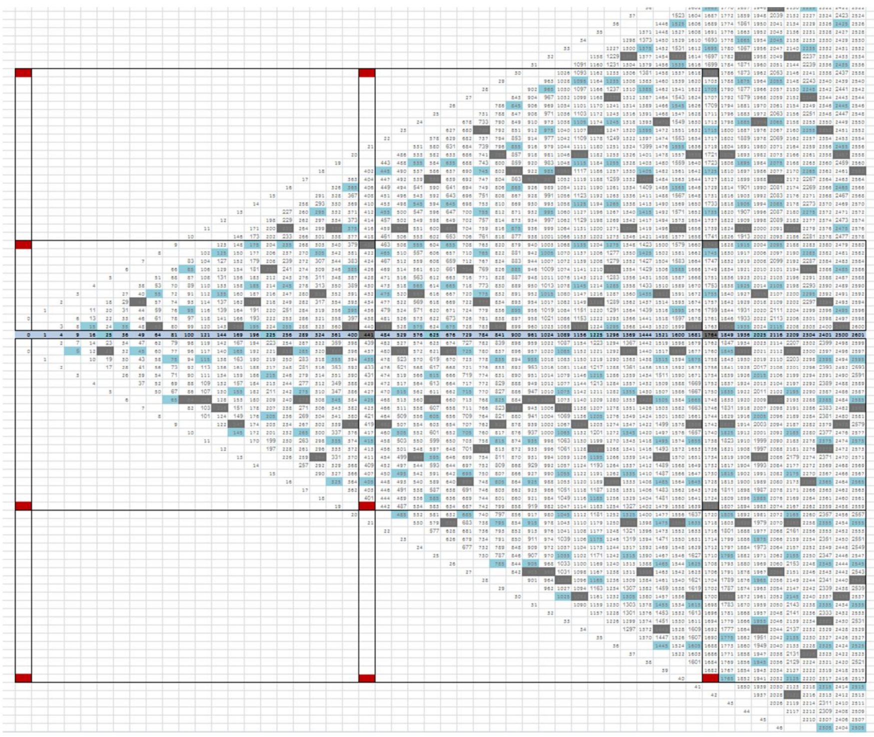
Column names: Modulo 4 divisor, Divisors and quartets, Number of periods up to a full parabola position, Position of parabola vertex in period cycle, Growth compared to the previous quartet

Dzielnik Modulo 4	Dzielniki i kwartety	Ilość okresów dla pełnej paraboli	Pozycja wierzchołka paraboli w okresie	Przyrost w stostunku do wcześniejszego kwartetu
1	1	1	1	1
3	3	1	2	3
1	5	1	4	5
3	7	1	7	7
1	9	2	2	1
3	11	2	5	3
1	13	2	9	5
3	15	2	14	7
1	17	3	3	1
3	19	3	8	3
1	21	3	14	5
3	23	3	21	7
1	25	4	4	1
3	27	4	11	3
1	29	4	19	5
3	31	4	28	7
1	33	5	5	1
3	35	5	14	3
1	37	5	24	5
3	39	5	35	7
1	41	6	6	1
3	43	6	17	3
1	45	6	29	5
3	47	6	42	7
1	49	7	7	1
3	51	7	20	3
1	53	7	34	5
3	55	7	49	7

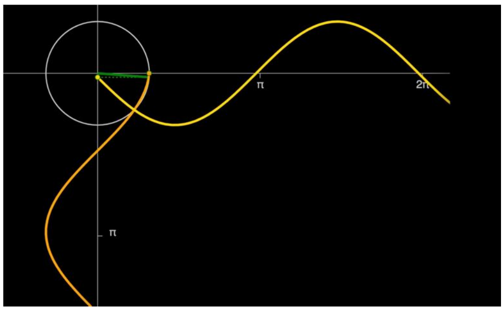


Periods of divisors in the Square Positional System

The upper period columns start at the value of the number 3. Factors start cyclically starting up to the middle of the period ending on the square axis. The bottom-period columns start at the value of the number 2. Cyclic divisors end with a full period. The parabolas are directed with their vertices to the axis of the squares. The figure below shows periods with overlapping columns.

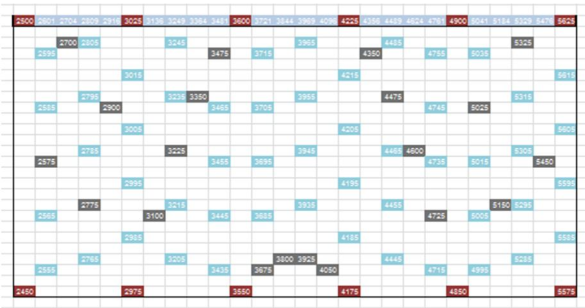


This relationship resembles the relationship between the trigonometric functions sine and cosine that draw a circle together.



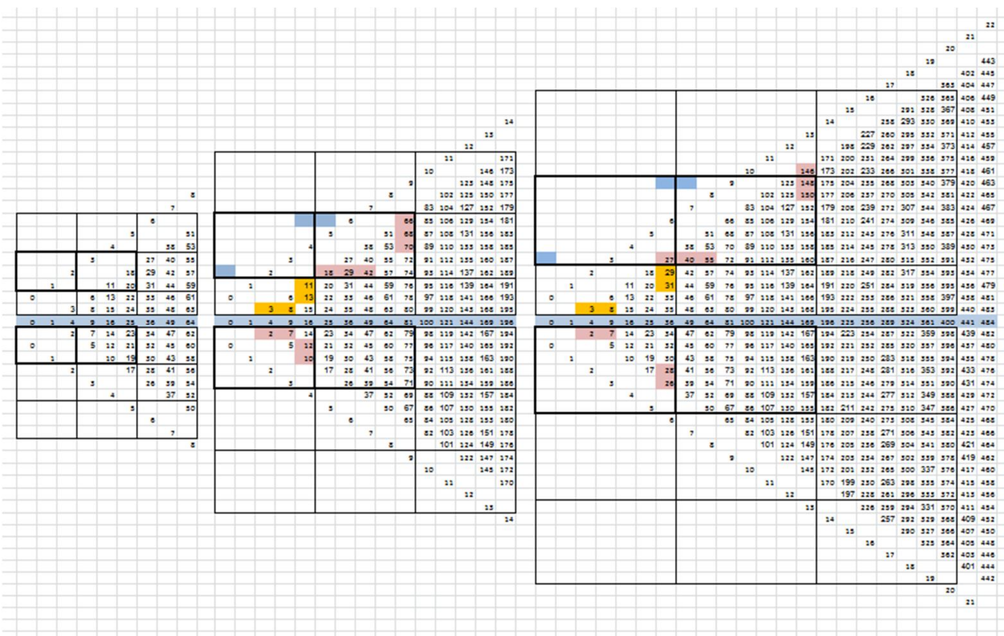
Source: Youtube channel: Khan Academy „Sine and cosine from rotating vector".
https://www.youtube.com/watch?v=a_zReGTxdlQ

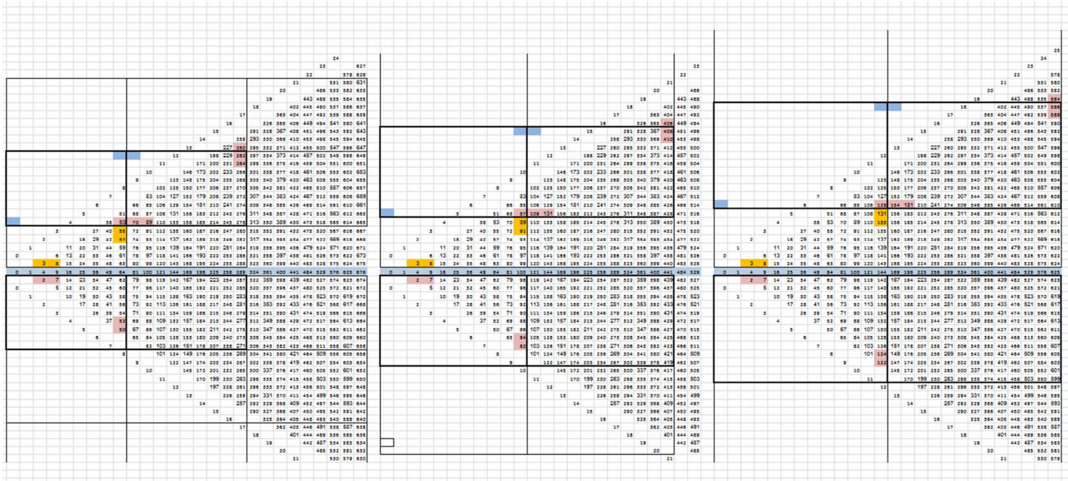
The first row of all divisors are represented in axis of squares. The first line of the divisor period is also the end of the arms of the parabola rising from the vertex. If the multiple of the divisor will be on the first line of its period it will also appear on the square axis. Below is an example for a divisor of n = 25



Increasing the periods of divisors

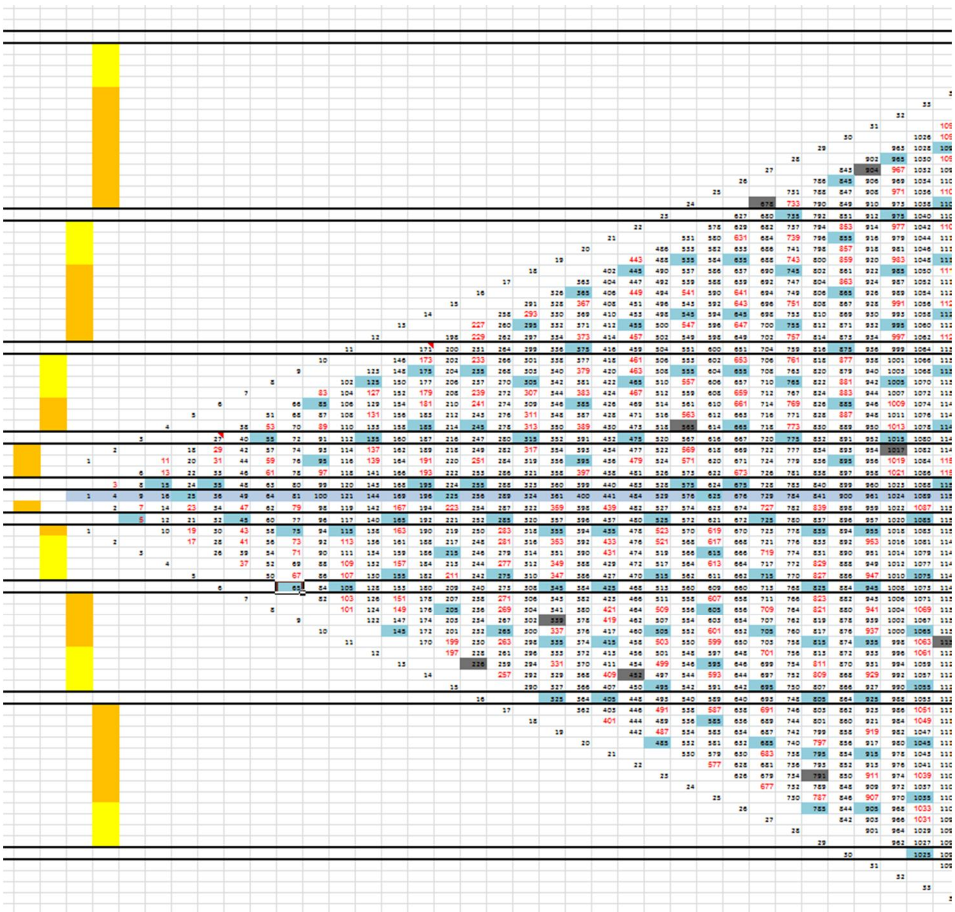
The colors orange pink and blue show the increment by the number of squared fields covered by the period as the range of numbers is expanding.



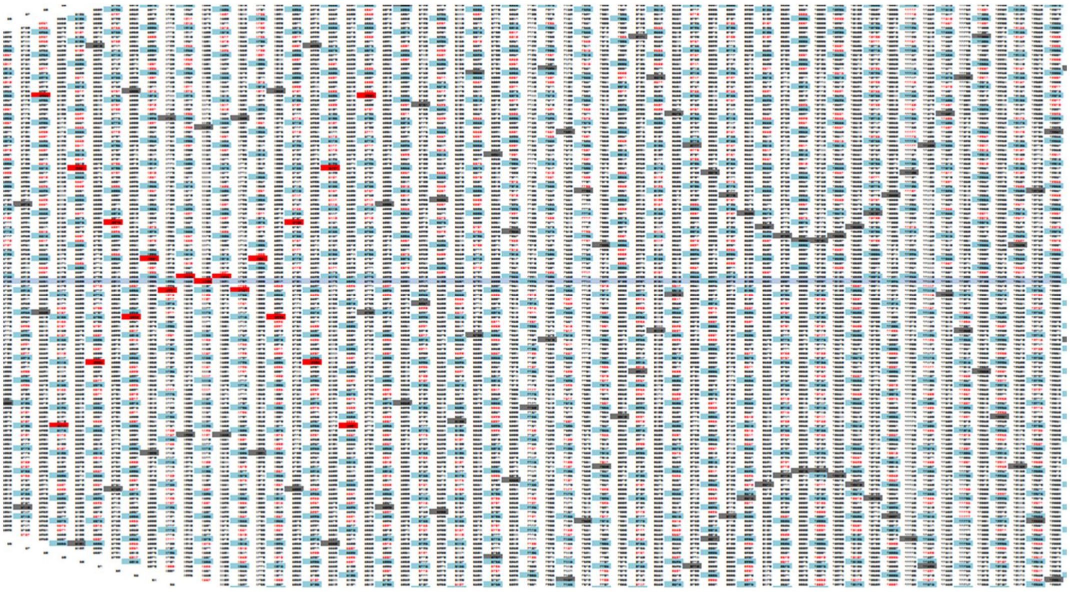


Horizontal divisors-line of complex numbers

Starting from the first line in a given group of columns the lines are spacing apart by a constant value of 4 lines. This is represented by the yellow-orange column. There are no prime numbers in these lines while the divisors of complex numbers are easily determined by the number of the column in which the complex number is located and the sequence number of the horizontal line counting from the square axis. The prime numbers are marked in red font color. The multiples of the number 5 are marked with a blue fields.



This property results from the next parabolic pattern that arises at the beginning and end of the period of each divisor. Fields marked in red.



Divisors of a complex number placed on the line, can be calculated using formula:

K – column number Square axis K*K

Column „top" half periodic

1 line: K-1 * K+1

2 line: K-3 *K+3

3 line: K-5 *K+5

4 line: K-7 *K+7

Column „bottom" full periodic

1 line: K-2 * K+2

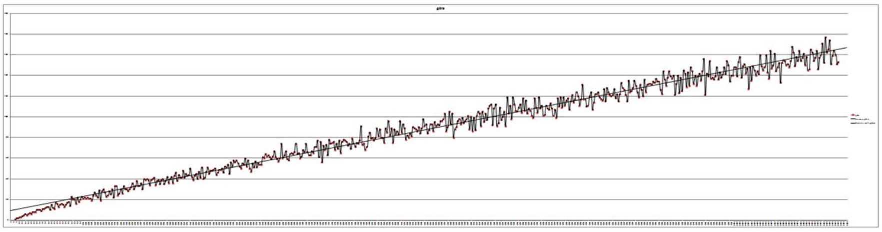
2 line: K-4 *K+4

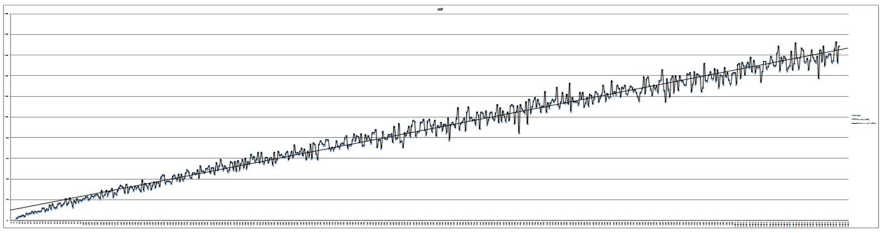
3 line: K-6 *K+6

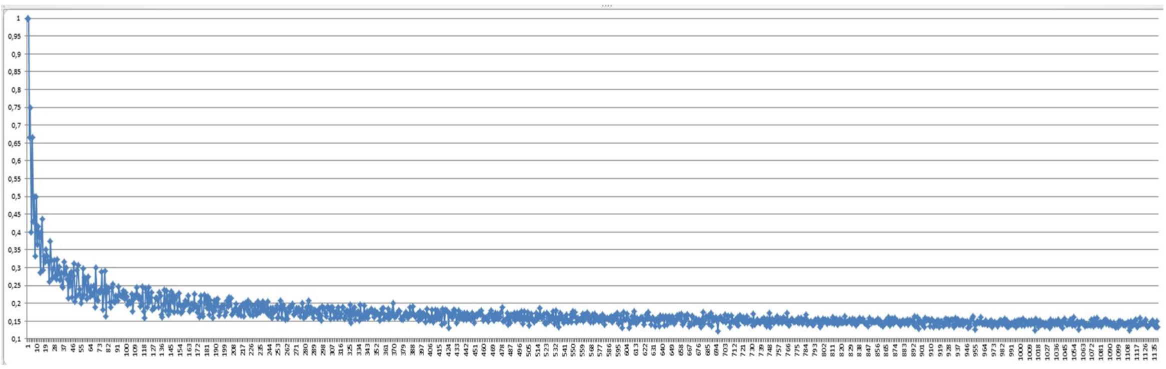
4 line: K-8 *K+8

Prime numbers in the Square Positional System

In a Square Positional System the prime numbers in each column are not hit by any of the earlier parabolic divisors. Then in the next columns the prime numbers (and the composite numbers) create successive ever larger and rarer parabolic waves. In the author's opinion prime numbers are signposts directing mathematicians to the source witch is the hidden and complex mechanism that orders the arrangement of prime numbers. Below there is a graph that counts the quantity of prime numbers in the half periodic and full periodic columns, and the fractional dependence of the prime numbers in a given column. For example in column 1139 153 prime numbers were counted which gives a fraction value about 0.134 ..



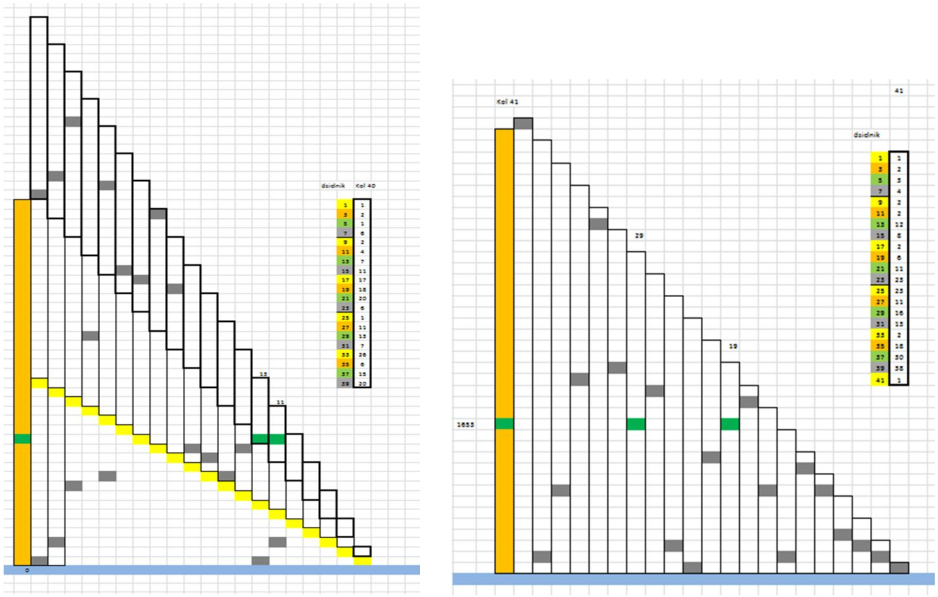




Factorization of complex numbers into divisors

The factorization process, consists in determining whether a complex number is in the half periodic or the periodic column. In the left figure for the number 1573 we know that it is in the even half periodic column K = 40. The green box in the orange column. The root of the number is 39,661... After rounding to an integer it indicates the columns and determines the position of the number in the distance from the square axis. In the illustration this line of boxes shows the decreasing series of half perdios for divisors 39 to 3. Divisors 11 and 13 are marked green. The number 1573 has 3 divisors 11 x 11x 13. Analyzing the number 1653 we calculate its root of 40.65. We know that it is in the full periodic column K = 41. The green squares in the right figure indicate divisors 29 and 19. The unselected divisor of 3 is also on the same level as the other divisors.

Factorisation is checking which of the potential divisors is in the position indicated by the number. Due to the relationship between the divisor's parabolas it is possible to select optimal starting places (vertex in example) that are close to the divisor of the number being checked. This is important for factorization of large numbers.



Comparison table of divisors in the following columns.

The linear relationship between divisors allows for a quick and simple calcuation iteration by adding or subtracting 'cursor' positions when searching for divisors. Double orange and yellow fields show the position of the vertex of the parabola period in the given divisor. The selected column on the right contains a list of the positions of individual divisor periods in the selected column. One of the best places to look for a divisor is to start at the top of the parabola (divisor 27 in the table) and check the divisor's position towards 39 by going through bold grids. Examples for columns 40 and 41. The arrangement of the prime numbers is also result of relationship between divisors shown in this table.

Kolumna

Dzielnik	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	1	2	2	1	2	2	1	2	2	1	2	2	1	2	2	1	2	2	1	2	2	1	2	2	1	2	2	1	2	2	1	2	2	1	2	2	1	2	2	1	2	2	1	2	2	1
5	1	3	4	4	3	1	3	4	4	3	1	3	4	4	3	1	3	4	4	3	1	3	4	4	3	1	3	4	4	3	1	3	4	4	3	1	3	4	4	3	1	3	4	4	3	1
7	1	4	6	7	7	6	4	1	4	6	7	7	6	4	1	4	6	7	7	6	4	1	4	6	7	7	6	4	1	4	6	7	7	6	4	1	4	6	7	7	6	4	1	4	6	7
9	1	5	8	1	2	2	1	8	5	1	5	8	1	2	2	1	8	5	1	5	8	1	2	2	1	8	5	1	5	8	1	2	2	1	8	5	1	5	8	1	2	2	1	8	5	1
11	1	6	10	2	4	5	5	4	2	10	6	1	6	10	2	4	5	5	4	2	10	6	1	6	10	2	4	5	5	4	2	10	6	1	6	10	2	4	5	5	4	2	10	6	1	6
13	1	7	12	3	6	8	9	9	8	6	3	12	7	1	7	12	3	6	8	9	9	8	6	3	12	7	1	7	12	3	6	8	9	9	8	6	3	12	7	1	7	12	3	6	8	9
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Kolumna

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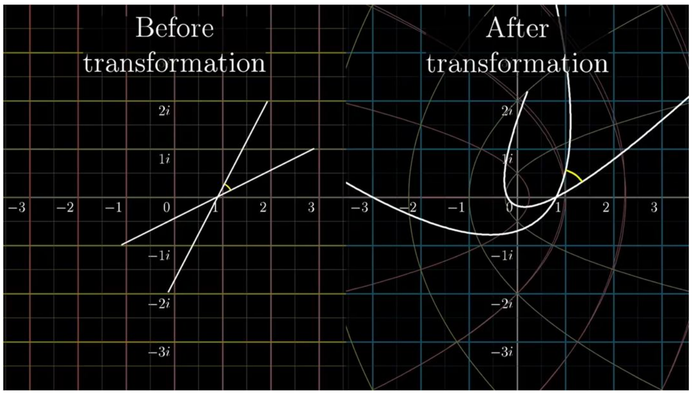
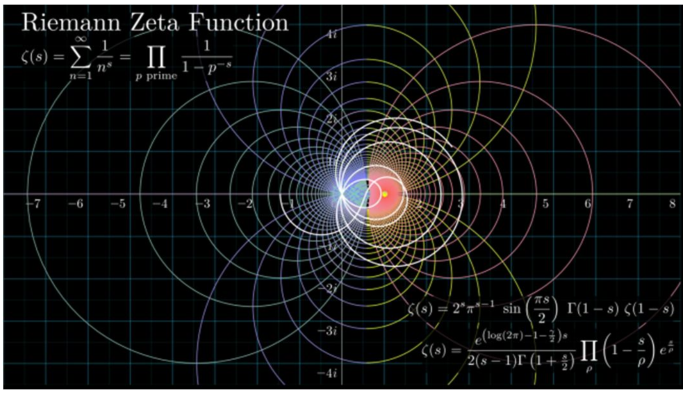
Riemann's Zeta function in relation to the Square Number Positional System

The Riemann Zeta function was created as an attempt to find the hidden sense of the distribution of prime numbers on the number line. By using innovative mathematical tools and by transferring the considerations to the 2-dimensional complex plane Riemann has captured the subtle quality of prime numbers. Failure to understand this property leaves the open question about the truth of Riemann's hypothesis despite the empirical premises for its truth. All non-trivial zeros calculated so far in the amount of about 10 ^ 24 leons on the critical line. In 1972 the meeting of Hugh Montgomery and Freeman Dyson resulted in finding the mutual dependence of the Riemann Zeta function with the atomic physics. Author began to wonder in with way the Zeta function is common with the Square Number Positional System. I base my assumptions on intuition and the conviction that the original properties of the numbers will be reflected in a changed and hidden form suggesting the direction of the search. Just like the analytical transformation of a function changes the shape of the line of the function but maintains the original angles before the transformation.



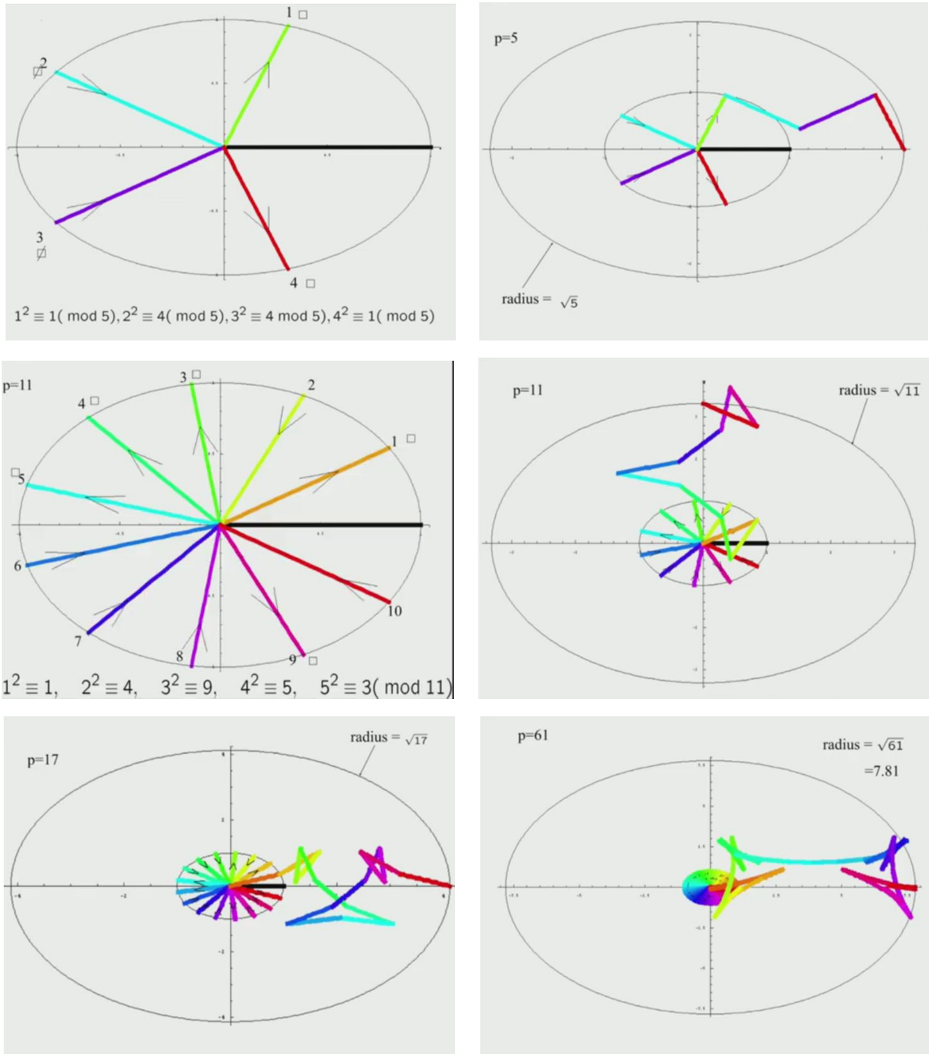


Source: Visualization of the Riemann hypothesis and analytical continuation, Youtube movie from channel 3blue1brown https://www.youtube.com/watch?v=sD0NjbwqlYw

Non-trivial zeros on the complex plane in the middle of the critical belt inform about odd numbers including prime numbers. The critical band of the Zeta function from 0 to 1 reflects the period of each odd divisor in the Square Number System. Starting at column 0 to column n for each divisor and the value n ^ 2 on the square axis. The critical strip of the Zeta function with zeros resembles the apex of the parabolic symetrical image of the divisors.

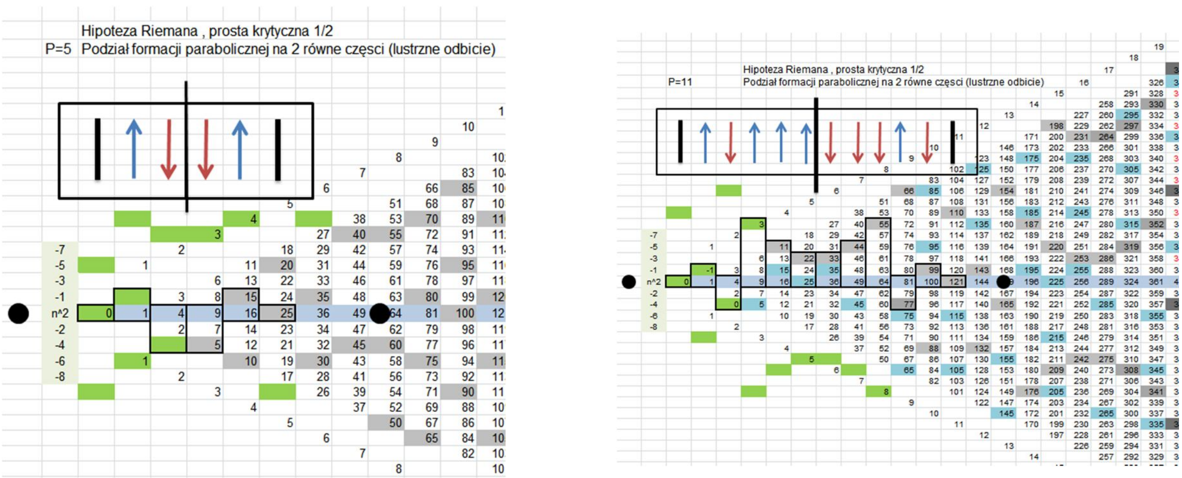
Mathematician Brian Conrey in his lectures: „Math Encounters - Primes and Zeros: A Million-Dollar Mystery" https://www.youtube.com/watch?v=OS2V6FLFmxU 59min 17sek, Palestra Especial: Brian Conrey - Primes and Zeros: A million dollar mystery (2011) https://www.youtube.com/watch?v=DO-Fh5OMMSk 46 min 50 sec :

„The Riemann Hypothesis is a statement about a deep connection between addiction and multiplication that we do not yet understand." Presents the essence of this problem he shows the slides of this relationship. *„This distance of 1/2 of the radius line between the radius of the circle P and the root of P is*
equivalent to the critical straight line 1/2 for the Riemann Hypothesis".

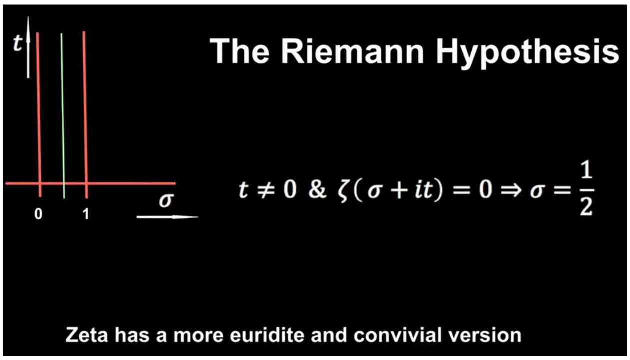


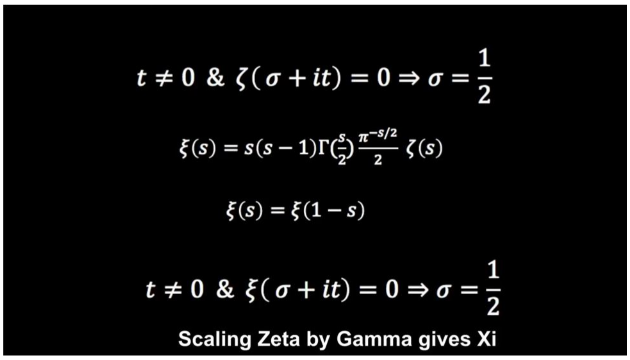
The symmetry of the configuration of color vectors together with the marked values of the modulo division indicate analogies of the symmetry of parabolic images of the periods of odd divisors.

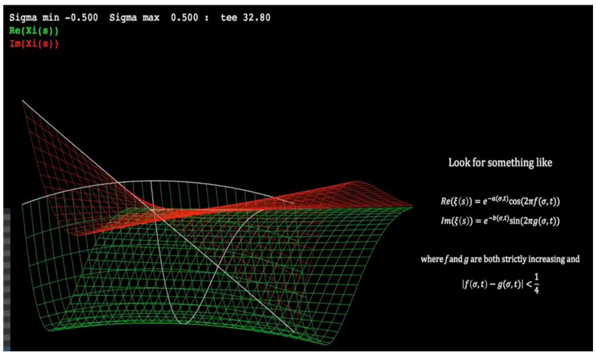
For an even exponent, numbers always returns to the square axis after expansion. This rule will also apply to the approximation of the irrationals of odd numbers.

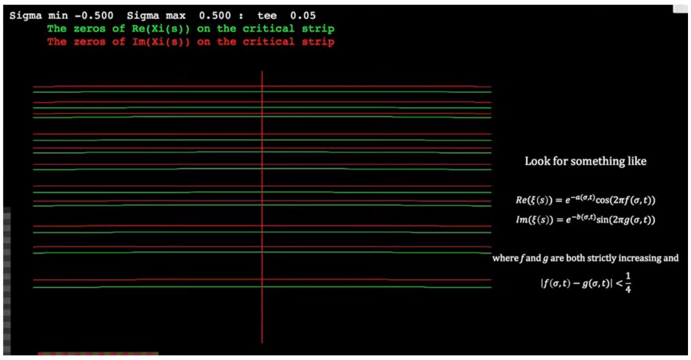


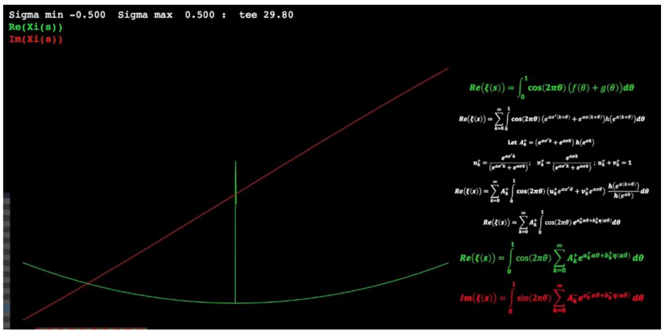
Unknown author on Yotube Channel: EulerToiler in Riemann Hypothesis movie description A visual tour of Xi Riemann's function looking at relationships with probability "source of heat" and wave function. Examined relation with Guy Robin's theorem. Link https//www.youtube.com/watch?v=r6sxqS0xyDk Concludes *„Where did Riemann have a vision to see, what he is looking at? The answer is the function of Xi"*. The following slides show the mutual wave motion between the real green parts for Re (Xi (s)) and the imaginary red part Im (Xi (s)) over the entire width of the critical strip range.

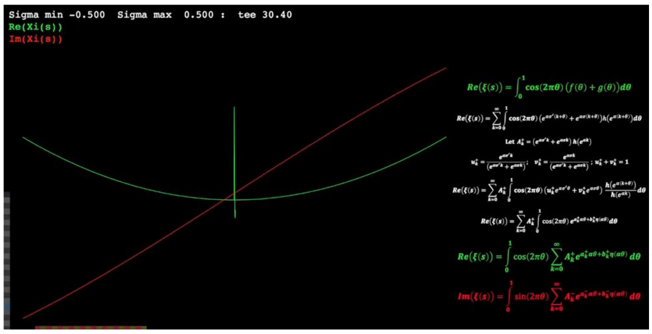


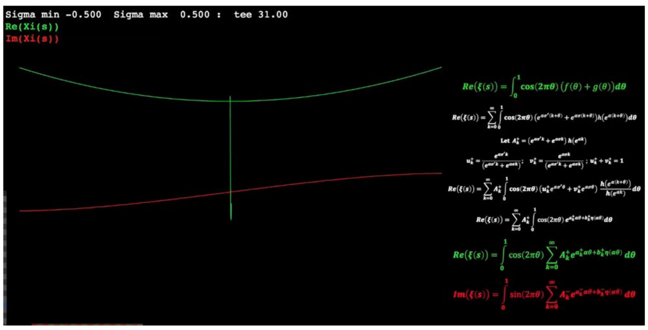


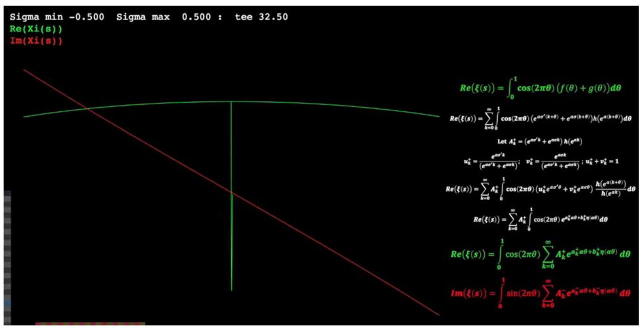


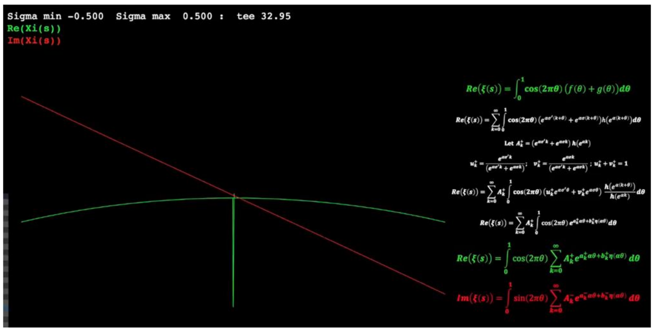


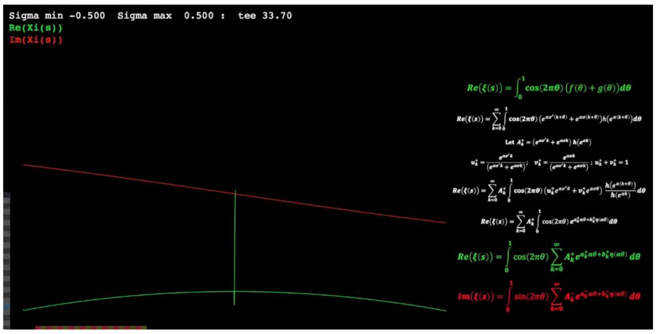




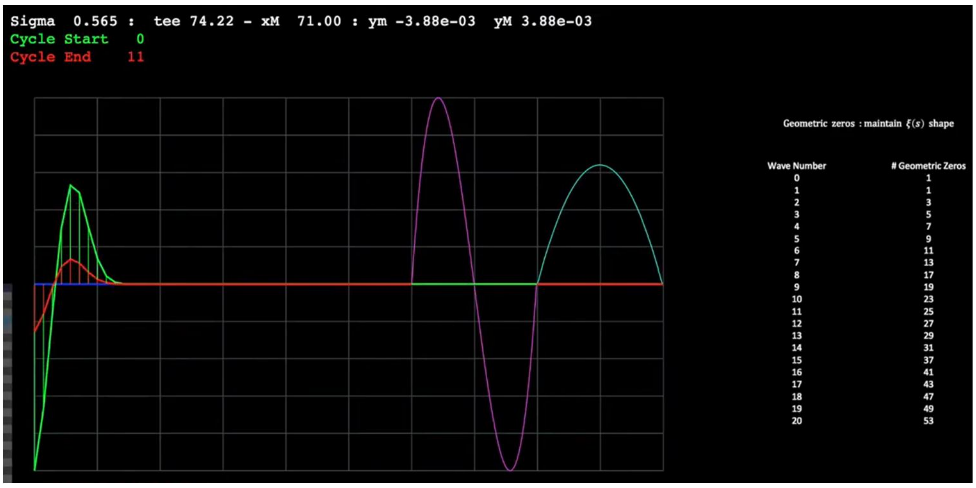






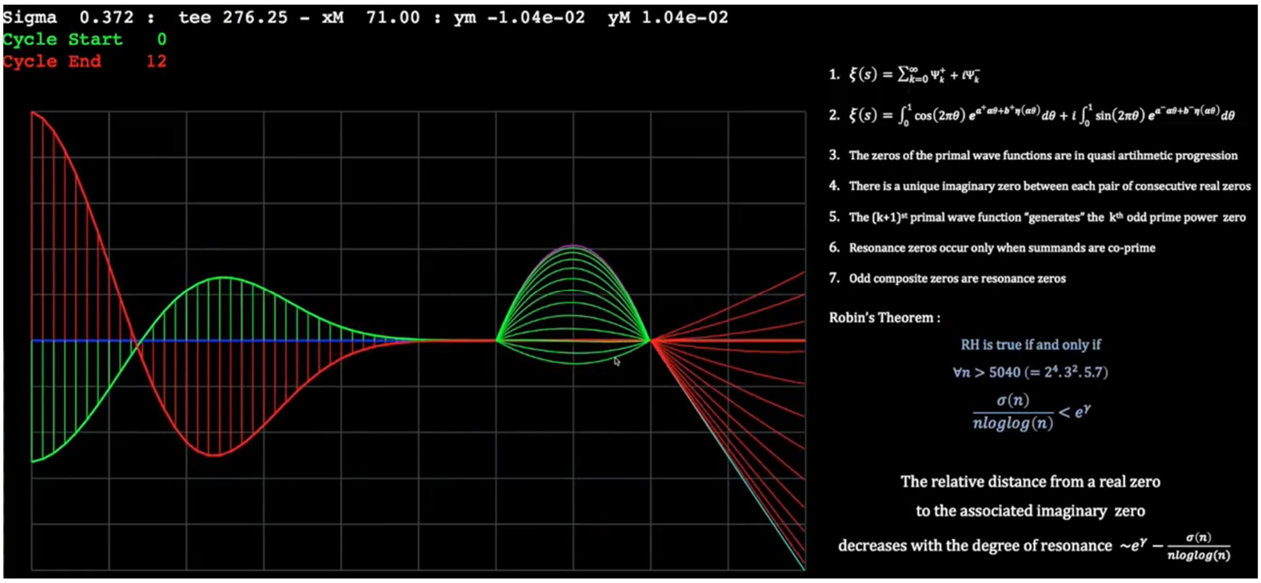


It is easy to notice the analog for the boundary limit range of natural numbers and the imaginary part Im (Xi (s)) of the red color. Parabolic images of multiple divisors odd numbers are presented as a flattened parabola of the real part Re (Xi (s)). Their joint movement draws the appearance of the Square Positional System as they move between successive natural numbers.



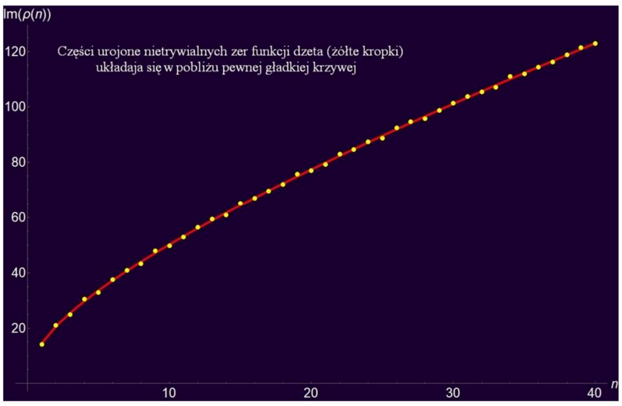
Quote: 5 mins 36sec: „The formula is such that the number / number of geometric zeros covered by n-wave functions is the n-t prime or power or a prime. As shown in the columns on the right. So each of the wave functions represents a prime number or a power of a prime number. The prime numbers correspond to single zeros of the wave function. For complex numbers this is a bit more interesting. They are made up of resonance zeros."

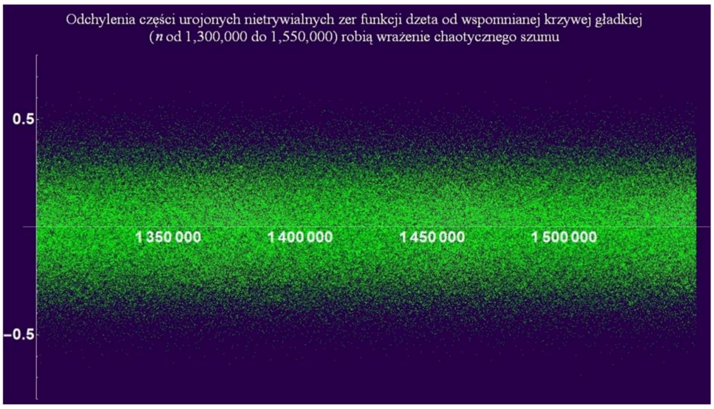
Quote: 8 min 00 sec: „We were thinking about looking for trigonometric functions to represent wave motion. What we found are modified hyperbolic expressions that behave almost the same in a hyperbolic manner. So we can briefly say seven things about the function Xi"

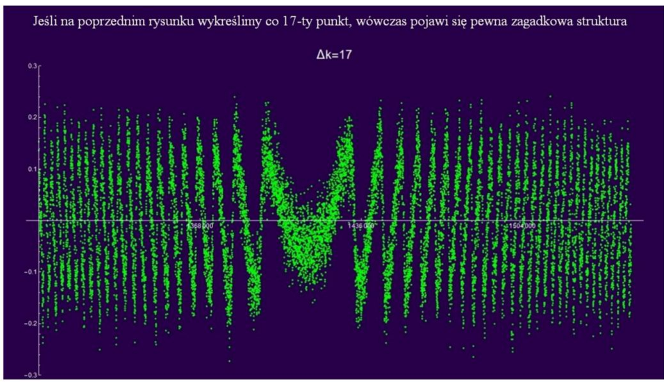


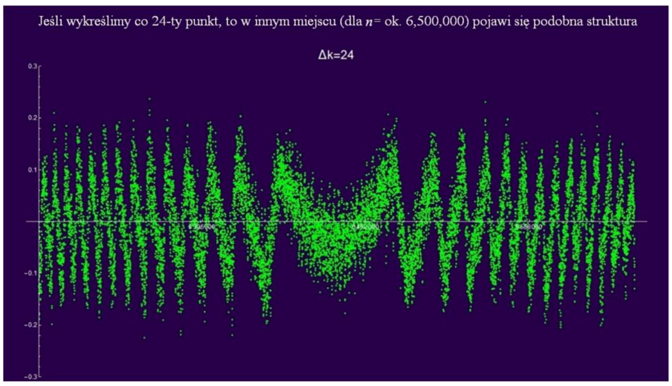
An interesting phenomenon was noticed by Mr. Krzysztof Maslanka when he presented in the on line conference "Three voices about Riemann Hypothesis" 03/24/2021 https://www.ptm.org.pl/zawartosc/minikonferencja-tr%C3%B3jg%C5%82os-o-hipotezie-riemanna-24-marca-2021-warszawa-line

„The procedure described above can be interpreted as follows. Let us treat the deviations of the imaginary nontrivial zeros of the zeta function as a certain discrete absolute "signal" (in signal theory the term is a time series; the philosopher would use the exalted name God-given). This signal takes the form of chaotic noise. However taking only selected elements of this signal namely spaced a certain fixed step from each other reveals unexpected puzzling structures at various points in the signal".

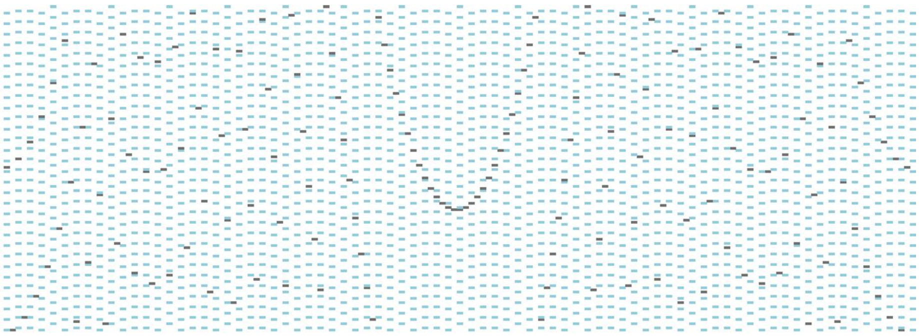








The observed signal is very similar to a parabolic picture plotted by multiples of an odd divisor. An example for a period of divisor n = 141. You can see a parabola with curled arms. Calculating from the formula n / 8 and rounding up to the nearest integer 141/8 = 17.625 => 18 we determine the number of periods needed to draw a complete picture of the parabola.



At the end

The question is, Can the Square Positioning System have practical application outside of mathematics? In the author's opinion yes. Let us pay attention to the sound thunder when exceeding the speed of sound in the air or the shape of Cherenkov radiation in an atomic reactor. Violation of the propagation center by a longitudinal axial impulse creates a characteristic slope/conical shape. In mathematics this medium are numbers as mathematical objects with own characteristic properties.

Can we explain physical phenomena using such analogies? I leave the above question open.

Yours sincerely Author

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Poland