PRIME NUMBERS AS THE FOUNDATION OF THE ZODIAC

By

David Cochrane
September 2014

Prime Numbers as the Foundation of the Zodiac
David Cochrane
September, 2014

Prime Numbers and the Zodiac

Prime numbers have fascinated mathematicians in ancient Greece and continue to fascinate mathematicians today. Prime numbers are regarded by some mathematicians as being like building blocks of the number system, roughly analogous to the periodic table of elements in chemistry. Some of the greatest mathematical minds of all times have tried to understand how the seemingly random distribution of prime numbers may contain a hidden order.

In this paper I describe how prime numbers distributed around a circle form bands of 30 degrees. Bands of 30 degrees are also used in astrology to define where zodiac signs begin and end. It is possible that the twelve equal bands of 30 degrees formed by prime numbers distributed around a circle form a basis for zodiac signs. However, the details of how these bands of 30 degrees created by prime numbers would be a basis for zodiac signs is not understood at this time. Nevertheless, it is possible that the discovery presented in this paper that prime numbers form bands of 30 degrees may provide the initial insight into a theoretical framework for understanding why zodiac signs may exist.

- *First I will describe the pattern of prime numbers and then I will describe how it may be a basis for the astrological zodiac.*

New Insights into Patterns in Prime Numbers

Prime numbers are divisible only by the number itself and the number 1. Prime numbers appear to be randomly distributed.

> For example, there are 38 prime numbers between 1 and 180 and they are: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97, 101, 103, 107, 109, 113, 127, 131, 137, 139, 149, 151, 157, 163, 167, 173, and 179. At first glance this series of numbers does not appear to have any clear pattern.

However, the only even prime number is two, so we can remove all even numbers except the number two. Thus, there is a kind of a pattern in that only odd numbers can possibly be prime (with the exception of the number two).

The Sieve of Eratosthenes is a mathematical procedure that identifies prime numbers by first removing the even numbers. After removing the even numbers (multiples of two), then all multiples of the next number in the remaining numbers are removed, so all multiples of 3 are removed. Then all multiples of 5, and then of 7 are removed, etc. Note that multiples of 4 and 6 have already been removed when multiples of 2 were removed so multiples of 4 and 6 do not need to be removed.

The Sieve of Eratosthenes reveals a kind of pattern in prime numbers in that prime numbers are the numbers that remain after multiples of numbers are removed. The pattern, however, is the complex result of many separate iterations through the numbers where each iteration removes some prime numbers. The Sieve of Eratosthenes is really simply a process for removing non-prime numbers rather than a process that reveals an elegant pattern in the prime numbers.

I have identified a variation of the Sieve of Eratosthenes that reveals a series of symmetric patterns. I have not mathematically proved that this formula works so this procedure can be referred to as a conjecture. Nevertheless, it is fairly evident to me that this conjecture is true and I believe that a mathematician who is an expert in prime number theory can prove it, and a computerized algorithm to test it would not find any violations of this conjecture.

My variation of the Sieve of Eratosthenes is as follows:

1. Multiply the first two prime numbers and call this value X. Take half of this amount and call it C (for "center point" for we shall see that it becomes a center point)

2. Write down a vertical list of numbers of Xn-C from n to whatever value you wish depending on how large of a table you would like

3. Enter all prime numbers from a list of prime numbers to the left and right of this vertical list of numbers. You will obtain a symmetrical pattern with all prime numbers being placed in less than half of the possible columns.

4. Repeat step 1 but multiply the next previously used prime numbers in step #1 with the next prime number and then repeat steps 2 and 3. Continue repeating for as long as desired.

Each iteration of the above four steps will produce a symmetric pattern of prime numbers. You can visualize the value X obtained in Step 1 as a pebble dropped in a calm lake. The columns of numbers observed in step 3 are like waves created by the pebble. All prime numbers exist on these waves.

Let's apply the formula and see the results. The first two prime numbers are 2 and 3, and 2x3 = 6, and half of 6 = 3. Thus our formula is 6n – 3. Now we list the value of 6n – H vertically for n = 1 to 7 (or up to whatever number we desire) and place the prime numbers to the left and right of it. For example, for n=1 6n – 3 =3, and for n=2 6n -3 = 9. We will put Hn in parentheses to distinguish it from the prime numbers. The results are shown in Table 1.

Table 1. Prime Numbers arranged by the formula 6n – 3 for n from 1 to 7

```
-2     (Center)   +2
- - - - - - - - - - - - - - - - - - - -
 1       (3)        5
 7       (9)       11
13      (15)       17
19      (21)       23
 -      (27)       29
31      (33)        -
37      (39)       41
etc.
```

Note: A dash ("-") indicates a number that is not a prime number but is in one of the two columns of numbers of prime numbers. Also note that the number 1 is included in this table although it is not regarded as being a prime number by mathematicians.

When prime numbers are put into Table 1, they appear only in two columns equidistant from the center point. For the first 6 iterations this formula is very efficient. Only two values that are obtained are not prime numbers. These appear as dashes in Table 1 and are the numbers 25 (5 x 5) and 35 (5 x 7).

Because the center point = 6n – 3 and the first column is two less than this value, the value in the first column equals 6n – 3 – 2 = 6n-5, and the value in the second column = 6n – 3 + 2 = 6n-1. Therefore, all prime numbers = either 6n-5 or 6n-1. Note that 6n-5 equal 6 (n-1) + 1.

> For example, if n = 5, then 6n-5 = 25 and 6 (n-1) + 1 also = 25. Because the value of n can repeat up to infinity so it really does not matter whether we refer to n or n-1, n-5 is really equivalent to n+1.

The formula in Table 1 is more commonly expressed as 6n +- 1 where "+-" means plus or minus. This is a well-known formula in prime number theory so Table 1 does not introduce anything new to prime number theory. It is the next iteration in this process where the results start to get really interesting.

In the next iteration we include the next prime number so instead of 2x3 we use a value of 2x3x5 which equals 30. Half of 30 = 15. Our formula therefore is 30n-15. According to our conjecture, prime numbers are also symmetric around this number. Table 2 shows the results.

Table 2. Prime Numbers (and also the number 1) Up to 180 using the formula 30n-15

-14				*-8*	*-4*	*-2*	(Center)	*+2*	*+4*	*+8*	*+14*
1	2	3	5	7	11	13	(15)	17	19	23	29
31				37	41	43	(45)	47	–	53	59
61				67	71	73	(75)	–	79	83	89
–				97	101	103	(105)	107	109	113	–
–				127	131	–	(135)	137	139	–	149
151				157	–	163	(165)	167	–	173	179

Notes: The numbers 15, 45, 75, 105, 135, and 165 are the center of a symmetrical pattern within each row of numbers. A dash ("-") indicates a symmetrical point that is not a prime number. Also, the number 1 is not regarded by mathematicians as a prime number but is included in this table.

All prime numbers except the prime numbers used in the formula (2, 3, and 5) are perfectly symmetric around the center points. All prime numbers (except 2, 3, and 5) are in one of the 8 columns.

In Table 2 n has a value that varies from 1 to 6 and so there are 6 rows and all prime numbers appear in 8 columns. Therefore there are 48 (6 x 8) numbers identified as possibly being prime. All 39 prime numbers are found in these columns of 48 numbers. 39 divided by 48 = .81 so 81% of the possible numbers are prime. As we shall see, our percentage rate of finding prime numbers will be tremendously improved as we include additional center points by iterating through our procedure more times.

From the above we conclude that all prime numbers except 2, 3, and 5 are equal to:

(a) (6n-3)n +- 2 AND
(b) Either (30n-15) +- 2, (30n-15) +- 4, (30n-15) +- 8, or (30n-15) +- 14.

We can visualize this as all prime numbers existing on one of the waves symmetric around (6n – 3) AND on one of the waves symmetric around (30n – 15).

Now we shall iterate through the procedure again. The next prime number is 7, and 2x3x5x7 = 210. Half of 210 = 105. Therefore, our formula is 210n-105. The resulting table is very large.

In Table 3 we have plotted just a few numbers that are in this table. At a future time we may take the time to expand this table but the data shown is sufficient to appreciate that again the prime numbers are distributed in a symmetric pattern around the center points.

Table 3. Prime Numbers using the formula 210n-105

-34	-32	-26	-22	-16	-8	-4	-2	(Center)	+2	+4	+8	+16	+22	+26	+32	+34
71	73	79	83	89	97	101	103	(105)	107	109	113	–	127	131	137	139
281	283	–	293	–	307	311	313	(315)	317	–	–	331	337	–	347	349

Note: A dash ("-") indicates a number that is not a prime number but has an opposite symmetry point.

Table 3 is a small part of a very large table, but it shows that the prime numbers form a symmetric pattern around the numbers 105 and 315. If my conjecture is correct, prime numbers are also symmetric around 525 (n=3 in the formula 210n – 105), 735 (n=4 in the formula 210n – 105), etc.

In the first column of Table 3 (using the formula 210n – 105) the following prime numbers are correctly identified:

71, 73, 79, 83, 89, 97, 101, 103, 107, 109, 113, 127, 131, 137, and 139. The number 121 is incorrectly identified as a possible prime number.

In this same range of numbers Table 2 (using the formula 30n – 15) the same prime numbers were correctly identified as in Table 3 but there are more numbers incorrectly identified as a possible prime number; these numbers are 77, 91, 119, 121, and 133. Both formulas incorrectly identified 121 as a possible prime number but this is the only incorrectly identified prime number using the formula 210n – 105 whereas there are 4 additional numbers incorrectly identified by the formula 30n – 15. As we

iterate repeatedly through the procedure the formula is able to more precisely identify the prime numbers with an accuracy that approaches 100%.

If we iterate through the procedure again, our value is 2x3x5x7x11 = 2310. The iteration after that will use a value of 2x3x5x7x11x13 = 30,030. A computer program could be written to identify the rings that surround each of the center points and possibly discover other interesting characteristics of these rings, and possibly identify prime numbers more rapidly than with other algorithms.

Although each of these rings around the central numbers contains numbers that are not prime numbers, the fact that all prime numbers exist in these rings, that the majority of numbers are prime numbers and that the percent of numbers in these rings that are not prime numbers decreases with more iterations suggests that these rings are "real" (in a mathematical sense) and define an important structure of prime numbers. I find the symmetry, each iteration creating larger circles, and the prime number points existing at intersection points of these symmetric patterns fascinating and awe-inspiring.

Prime Number Cycles On the Zodiac Circle Begin Every 30 Degrees!

Although the way in which prime numbers are distributed in symmetric patterns is elegant and simple, people who are not mathematically inclined may find some of the technical details described above a bit obscure. The main point for those who are "numerically challenged" is that prime numbers exist in symmetric patterns that have lengths of 6, 30, 210, 2310, 30030, etc. As we shall see in the discussion below, the cycle of 30 degrees has a very special and powerful relationship to prime numbers when prime numbers are placed around a circle.

As explained below, the infinitely expanding symmetric patterns described above focus at points every 30 degrees around a circle, thus anchoring this infinite expanse of prime numbers at distances that astrologers identify as having the same length as the zodiac signs! As far as I know, this observation of the pattern of prime numbers is a new discovery, at least in modern times.

This discovery may perhaps be a re-discovery of something discovered when the concept of the zodiac was developed and refined or perhaps simply gives a conceptual framework for understanding why the zodiac may be important.

To see how these prime number patterns may relate to the astrological zodiac, we can bring our attention back to Tables 1, 2, and 3. These tables show that there is a repeating pattern to the prime numbers. All prime numbers are:

(1) Symmetric points that are +2 or -2 in a cycle of length of 6 as shown in Table 1,

(2) Symmetric points that are +2, +4, +8, +14, -2, -4, -8, or -14 in a cycle of length of 30 as shown in Table2 , and

(3) Symmetric points that are equidistant with a length of 210 as shown in Table 3. **The critical point being made here is that there are natural symmetrical prime number cycles with a length 6, 30, and 210.**

To repeat: prime numbers are arranged in symmetric cycles of length 6, 30, and 210. If we place these prime number cycles around a circle we have a prime number cycle that begins at every 6 degrees, every 30 degrees, and every 210 degrees. Another word for cycle that we can use is phase. From an astrological perspective, does it make sense that some new phase, new quality, or experience begins at every six degrees, every 30 degrees, and every 210 degrees? A cycle or phase beginning at every 30

degrees is similar to the 12 zodiac signs of 30 degrees in length. A cycle or phase of 210 degrees is the length of 8 zodiac signs. Two cycles of 210 degrees = 420 degrees. Going around the circle we subtract 360 so two cycles = 60 degrees. Adding 210 again brings us to 270. If we imagine the prime number sequence starting at 0 Aries, then 210 is the beginning (0 degrees) of Scorpio, 60 is the beginning of Gemini, and 270 is the beginning of Capricorn.

Now consider the next iteration in our procedure for determining symmetric prime number patterns: after 210 is 2x3x5x7x11 = 2310. Applying the modulus 360 function to keep this number on a circle results in a value of 150, which is also a multiple of 30 degrees. In astrological terminology we can say that this cycle produces zodiac signs that are separated by five zodiac signs. If we consider the next cycle of 2x3x5x7x11x13 = 30,030 we will again find the result is a multiple of 30 degrees. Arguably the most startling discovery for astrologers presented in this paper is that all prime number patterns when placed around a circle have lengths that place the starting and ending points of the pattern at multiples of 30 degrees, thus coinciding with the concept of 12 critically important 30-degree sections of the circle used in astrology.

To make this point clearer and to show some of the details of how this works out, the starting points of the prime number cycles produced by the first 10 iterations of the Sieve of Eratosthenes are shown in Table 4.

Table 4. Prime Number Cycles Placed on Zodiac Circle

Degrees   *Start of Cycles*

2   0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28 degrees of every zodiac sign
6 (2x3)   0, 6, 12, 18, 20, and 24 degrees of every zodiac sign

     The following cycles begin at 0 degrees of the signs in this order:

Degrees	Start of Cycles
30	♈ ♉ ♊ ♋ ♌ ♍ ♎ ♏ ♐ ♑ ♒ ♓
210 (2x3x5x7)	♈ ♏ ♊ ♑ ♌ ♓ ♎ ♉ ♐ ♋ ♒ ♍
150 (2x3x5x7x11)	♈ ♍ ♒ ♋ ♐ ♉ ♎ ♓ ♌ ♑ ♊ ♏
150 (2x3x5x7x11x13)	♈ ♍ ♒ ♋ ♐ ♉ ♎ ♓ ♌ ♑ ♊ ♏
30 (2x3x5x7x11x13x17)	♈ ♉ ♊ ♋ ♌ ♍ ♎ ♏ ♐ ♑ ♒ ♓
210 (2x3x5x7x11x13x17x19)	♈ ♏ ♊ ♑ ♌ ♓ ♎ ♉ ♐ ♋ ♒ ♍
150 (2x3x5x7x11x13x17x19x23)	♈ ♍ ♒ ♋ ♐ ♉ ♎ ♓ ♌ ♑ ♊ ♏
30 (2x3x5x7x11x13x17x19x29)	♈ ♉ ♊ ♋ ♌ ♍ ♎ ♏ ♐ ♑ ♒ ♓
210 (2x3x5x7x11x13x17x19x29x31)	♈ ♏ ♊ ♑ ♌ ♓ ♎ ♉ ♐ ♋ ♒ ♍
210 (2x3x5x7x11x13x17x19x29x31x37)	♈ ♏ ♊ ♑ ♌ ♓ ♎ ♉ ♐ ♋ ♒ ♍

Note: By definition all cycles begin at 0 degrees Aries because this is the beginning of the zodiac.

The astounding and mind-boggling conclusion is that prime numbers exist in a complex tapestry of symmetric patterns that when placed around a circle have phases that intersect at every 30 degrees along the circle! This is an extraordinary mathematical phenomenon.

Are Prime Number Cycles Really Relevant to Astrology?

We have established that prime numbers are arranged in various symmetric cyclic patterns and these symmetric cyclic patterns placed around the wheel converge every 30 degrees, which are the starting points of each zodiac sign. This result is mathematically elegant and awe-inspiring. However, is it relevant to astrology? One could argue that there many fascinating mathematical algorithms and that one of them should coincide with an astrological doctrine may be a coincidence.

There are at least three ways that we can view the convergence of prime number cycles with the length of zodiac signs:

(1) a mere coincidence of no importance,

(2) One of the motivating reasons why the 12-sign zodiac was created and this discovery is actually a re-discovery or re-tracing of the thoughts that occurred to astrologers over 2,000 years ago, or

(3) this is a new discovery and provides the first steps towards establishing a theoretical framework and foundation for why zodiac signs exist.

It is also possible that this discovery is a re-tracing of the founders of astrological thought AND provides the initial groundwork for a theoretical framework for the existence of zodiac signs.

The zodiac of 12 equally sized 30 degree sections was developed some time during the first millennium BC. There are numerous references for this and this is firmly established by the historical records according to virtually all academic experts in the study of the origins of astrology.

Most experts place the invention of the zodiac of 12 equally sized zodiac signs some time between about 600 BC and 250 BC. By 200 AD astrology as we know it with the rules for planets ruling signs, use of solar returns, interpretation of individual degrees, etc. was firmly established. The theoretical edifice of what we now think of astrology was built in an extraordinarily short amount of time. Prior to this development there was period of over 2,000 years of sky omens but this very early form of astrology did not have a zodiac of 12 equally sized signs.

Eratosthenes (circa 276 – 195 BC) and Euclid (circa 300 BC) lived within at most a few hundred years of when the modern zodiac was established. We can reasonably assume that at least some of the people who established these astrological ideas were very aware of the developments in mathematics that were occurring in that same region of the world. It would be virtually impossible not to be aware of these developments in mathematics and influenced by them in some way.

Pythagoras lived earlier (circa 570 – 495 BC) so enthusiasm for numbers and mathematics was widespread during the development of astrological theory. One can easily imagine that somebody would have applied the Sieve of Eratosthenes to a circle and made the same observations that I made above. Given the mathematical sophistication of people at the time and the huge interest in prime numbers and the development of astrological theory, and that this discovery is not complex, one could argue that it would be very likely.

It is also reasonable to assume that people approached astrology with varying perspectives and philosophical assumptions and interests and that only some of the astrological thinkers at this time would take an interest in this relationship of prime numbers to astrology, but it very well could have had a direct influence on the formation of astrological ideas. Keep in mind that fascination with prime

numbers was strong in mathematics in the ancient Hellenistic world just as it is today among some people. On the other hand, to my knowledge there is no extant literature that indicates that astrologers in this time period were incorporating prime numbers above 16 in any way within the context of the astrological ideas. Most of the information on the early development of astrology is lost due to the burning of libraries and other destruction and the early roots of astrology may be forever shrouded in mystery. Nevertheless, the lack of any evidence that higher harmonic numbers were incorporated into the astrological model suggests that the ancients were not aware that twelve equal divisions of 30 degrees are created by the patterns of prime numbers.

Also interesting is that the planetary rulers of zodiac signs are arranged symmetrically regardless of the prime number cycle. In Table 5 the angles of 30, 150, and 210 appear as the length of prime number cycles. The angle of 30 degrees is simple the zodiac signs in proper order from Aries to Pisces. The 150 and 210 angles change signs by the quincunx aspect in astrology. The 330 degree angle does not appear in Table 4 and perhaps would appear if we analyzed additional prime number cycles, and perhaps other angular distances would also appear. In any case, the value of 330 is also included in Table 5.

Table 5. Relationship of Sign Rulers and Prime Number Cycles

Degrees

30	Signs:	♈	♉	♊	♋	♌	♍	♎	♏	♐	♑	♒	♓
	Rulers:	♂	♀	☿	☽	☉	☿	♀	♂	♃	♄	♄	♃
150	Signs:	♈	♍	♒	♋	♐	♉	♎	♓	♌	♑	♊	♏
	Rulers:	♂	☿	♄	☽	♃	♀	♀	♃	☉	♄	☿	♂
210	Signs:	♈	♏	♊	♑	♌	♓	♎	♉	♐	♋	♒	♍
	Rulers:	♂	♂	☿	♄	☉	♃	♀	♀	♃	☽	♄	☿
330	Signs:	♈	♓	♒	♑	♐	♏	♎	♍	♌	♋	♊	♉
	Rulers:	♂	♃	♄	♄	♃	♂	♀	☿	☉	☽	☿	♀

Notes: (1) Reading the red planets from left to right and the blue planets from right to left results in the same order, except for the Sun and Moon which is the Sun for the red planets and Moon for the blue planets. (2). In the first 12 prime number cycles zodiac signs appear separated by 30, 150, or 210 degrees. Prime number cycles above this have not been calculated yet but it is expected that a value of 330 may appear as it would be an additional symmetrical point to complement the distances of 30, 150, and 210 degrees.

Table 5 shows the order of the rulers of the zodiac signs. In other words, Mars rules Aries, Venus rules Taurus, Mercury rules Gemini, etc. so the order of the ruling planets is given for each of the four orderings of the zodiac signs.

If you read the red planets in Table 5 from left to right and you read the blue planets from right to left, then you obtain the same order of planets except that the Sun and Moon are paired with the Sun being in the list of red plants and the Moon being in the list of blue planets. For the 30 degree angles, for

example, the red planets are Sun-Mercury-Venus-Mars-Jupiter-Saturn and the blue planets read in reverse (right-to-left) order are Moon-Mercury-Venus-Mars-Jupiter-Saturn. The lists are the same except that Sun and Moon are paired together. This relationship of planetary rulers to zodiac signs has been mentioned by many astrologers. The main point here is that a symmetry of the planetary rulers is preserved in all of the prime number cycles observed so far.

The symmetry of rulers of planets is not preserved for any sequence of zodiac signs. Suppose, for example, that we add a 5th section to Table 6 for an angle of 60 degrees. Using this order the zodiac signs are in the order: ♈ ♊ ♌ ♎ ♐ ♒ ♉ ♋ ♍ ♏ ♑ ♓ and the ruling planets are in this order: ♂ ☿ ☉ ♀ ♃ ♄ ♀ ☽ ☿ ♂ ♄ ♃. If there is a symmetry in this list of planets, There is no symmetry in this list. In other words there is no point in this sequence of planets, where we can read towards the right and towards the left and obtain the same list of planets.

This observation of rulers is presented as a mysterious coincidence. The symmetry in planetary rulers that many astrologers have noted is very important in the theoretical framework of ancient astrology is preserved in the prime number cycles. The order of the planets has changed but there is still a symmetry. Were some of the founders of astrological theory around 300 BC aware of this? We may never know, but I present this as an interesting observation that other astrologers may perhaps develop further. Some astrologers might argue the case that this additional coincidence further suggests that the ancient astrologers were consciously aware of the prime number cycles. I am unsure about this at the moment.

Regardless of whether any of the founders of astrological theory were aware of prime number cycles, the question remains as to whether prime number cycles in some way create zodiac signs or are an integral part of the existence of zodiac signs (assuming that one believes that zodiac signs have some validity or importance).

Consider that prime numbers are considered by some mathematicians to be the building blocks of the number system. Prime numbers are analogous to the elements in chemistry that comprise all of the physical world. Prime numbers have been a focus of attention for many of the greatest mathematical minds in ancient as well as modern history. Given the great importance of prime numbers as being very fundamental to all of mathematics, and given that prime numbers are arranged in an infinite number of symmetries, and given that all of these symmetries beginning with the symmetry based on 30 coincide with the 12-fold cycle of 30 degrees, regarding this as mere coincidence appears to not be justifiable.

Mathematics is the language of science. As physicist Richard Feynman stated, without mathematics there is no science. Mathematics is, of course, a language of numbers and prime numbers are like elemental or essential numbers that hold the fabric of numbers together. These essences are distributed in beautiful symmetries that expand out to infinity and all of these infinite symmetries created by these fundamental essences are bound together in a consistent tapestry of 12 phases of 30 degrees.

The awesome wonder of this, the almost magical beauty of it and the fact that a great many mathematical discoveries appear first as pure mathematical insights with no application later to be applied in useful applications suggest that in some way this phenomenon of prime number cycles integrating and coalescing into 12 sections of 30 degrees must in some way have some greater relevance and significance than the sheer awesomeness of it as a mathematical phenomenon.

Summary and Concluding Comments

Many ideas have been introduced in this paper. Below I summarize key points and conclusions.

A variation of the Sieve of Eratosthenes reveals that prime numbers are organized in ever increasing symmetrical patterns. Using a modulus 360 function to arrange these numbers around a circle reveals that an infinite number of symmetrical prime number patterns have a length that is a multiple of 30 degrees. Restated slightly differently, prime numbers are patterned in a manner that emphasizes multiples of 30 degrees as critical starting and ending points of phases on a circle. The astrological concept of zodiac signs also assumes that there are critical phases that begin and end at 30 degrees around the ecliptic circle. Thus, zodiac signs and the patterns of prime numbers arranged around a circle are built upon the same framework of twelve sections of 30 degrees. Whether this is a coincidence, a founding concept behind zodiac signs, and/or a mathematical basis for zodiac signs is not known at this time.

At this point in the study of the patterns formed by prime numbers distributed around a circle gives no indication of how each 30 degree section may be qualitatively different from other 30 degree sections. The prime number patterns indicate only that the stating points of the zodiac signs are critical points that are divisions of symmetric patterns and the end of one cycle and the beginning of another cycle. At this point in our understanding of these patterns there is no clear indication that these patterns are qualitatively different in each of the twelve 30 degree sections. Nevertheless, the discovery presented in this paper that these 30 degree phases exist was previously unknown or disregarded and perhaps at some future time a greater understanding of these symmetric prime number patterns will reveal qualitative differences between the twelve 30 degree sections. Also, prime number theory does not at this point suggest where a starting point on the circle would be.

Because the development of mathematics and interest in prime numbers and the use of the Sieve of Eratosthenes was employed around the same time and place that the concept of equally sized zodiac signs was introduced, it is possible that some developers of the equally sized zodiac sign concept in antiquity had discovered this variation of the Sieve of Eratosthenes and it influenced them in formulating the model of zodiac signs as equally spaced 30 degree sections and perhaps also influenced the order of the ruling planets of zodiac signs so that the order remains symmetrical with very large symmetric prime number patterns (at least up to the 10th iteration of the modified Sieve of Eratosthenes introduced in this paper). A strong argument against the possibility that these ancient astrologers were aware of the 30 degree sections created by the patterns of prime numbers is that there is no extant literature indicating that prime numbers above 13 were used in the astrological models that were developed. Most of the details of early astrology are not known and access to much of this information has been destroyed by the burning of libraries and other destruction and decay of manuscripts and other primary source materials over time.

Whether zodiac signs that astrologers believe in actually have any validity is highly controversial. Astrologers have varying opinions about how zodiac signs function, whether they can be validated through scientific research and even what the starting point of the zodiac signs is (tropical versus sidereal zodiac signs). If there is some validity and meaning to zodiac signs, then perhaps the 30 degree length of phases of the prime number patterns when placed around a circle is in some way a basis for the existence of zodiac signs. At this point this is merely a speculation but it is a speculation that provides an initial concept that might serve to develop a theoretical framework that would support the concept of zodiac signs as having some kind of validity and usefulness.

For people who regard any astrological ideas as being purely pseudoscientific, the insights into the symmetric patterns of prime numbers described here hopefully will prove to be useful and will be

further developed by other mathematicians. I have not previously encountered a description of the iterative procedure described in this paper to create larger symmetric prime number patterns but I assume that some prime number theorists are aware of it. That these patterns reduce to multiples of 30 degrees in modulus 360 possibly was not previously noticed or not considered noteworthy. I am not aware of anyone having studied and described how the rings surrounding the centers of symmetry are arranged, and the ratio of actual to potential prime numbers in various rings analyzed simply for the purpose of understanding these patterns even if there is no practical application of this understanding. There might, however, emerge from these analyses some useful results such as methods for more rapidly identifying prime numbers with highly efficient algorithms.

For people who regard astrology as having validity, the discovery that the building blocks of the number system, the elemental and fundamental numbers upon which the entire number system is built, form cycles around a circle in perfect 30 degree sections is curiously identical to the concept that there are 12 cosmic bands of 30 degrees which have a fundamental effect on life processes. Astrologers assume that there is a cosmic structure and design based on 12 bands of 30 degrees and numbers are also structured in 12 bands of 30 degrees. If this identical structure is more than a coincidence, then prime numbers may in some way be the basis of zodiac signs. If this is true, then this suggests that prime numbers, including very high prime numbers, are very relevant and important for understanding astrology.

This conclusion is consistent with the astrological models that I use and a system of astrological analysis that I refer to as vibrational astrology. In vibrational astrology prime numbers up to at least the 200's and probably the 300's or higher are of fundamental importance. Interestingly, prime numbers may be extremely important, thus implying that astrology would benefit by evolving out of a strict 12-based orientation while also retaining the twelve equally sized bands of 30 degrees as having special importance. In short, the implications of the discovery of patterns of prime numbers around a circle presented in this paper suggest that harmonics and vibrational astrology may be more important than astrologers have believed, but that the zodiac or other divisions of a circle into twelve equally sized bands of 30 degrees is also important. The special significance of the zodiac does not contradict, and amazingly is consistent with, an emphasis on prime numbers, harmonics, and vibrational astrology.

Appendix

While studying the ideas presented in this paper you may wish to refer to a table of prime numbers. In case you are reading this paper in an offline format and cannot use a search engine to quickly obtain a table of prime numbers, one is included here for reference.

Table of First 1000 Prime Numbers (from http://primes.utm.edu/lists/small/1000.txt):

2	3	5	7	11	13	17	19	23	29
31	37	41	43	47	53	59	61	67	71
73	79	83	89	97	101	103	107	109	113
127	131	137	139	149	151	157	163	167	173
179	181	191	193	197	199	211	223	227	229
233	239	241	251	257	263	269	271	277	281
283	293	307	311	313	317	331	337	347	349
353	359	367	373	379	383	389	397	401	409
419	421	431	433	439	443	449	457	461	463
467	479	487	491	499	503	509	521	523	541
547	557	563	569	571	577	587	593	599	601
607	613	617	619	631	641	643	647	653	659

661	673	677	683	691	701	709	719	727	733
739	743	751	757	761	769	773	787	797	809
811	821	823	827	829	839	853	857	859	863
877	881	883	887	907	911	919	929	937	941
947	953	967	971	977	983	991	997	1009	1013
1019	1021	1031	1033	1039	1049	1051	1061	1063	1069
1087	1091	1093	1097	1103	1109	1117	1123	1129	1151
1153	1163	1171	1181	1187	1193	1201	1213	1217	1223
1229	1231	1237	1249	1259	1277	1279	1283	1289	1291
1297	1301	1303	1307	1319	1321	1327	1361	1367	1373
1381	1399	1409	1423	1427	1429	1433	1439	1447	1451
1453	1459	1471	1481	1483	1487	1489	1493	1499	1511
1523	1531	1543	1549	1553	1559	1567	1571	1579	1583
1597	1601	1607	1609	1613	1619	1621	1627	1637	1657
1663	1667	1669	1693	1697	1699	1709	1721	1723	1733
1741	1747	1753	1759	1777	1783	1787	1789	1801	1811
1823	1831	1847	1861	1867	1871	1873	1877	1879	1889
1901	1907	1913	1931	1933	1949	1951	1973	1979	1987
1993	1997	1999	2003	2011	2017	2027	2029	2039	2053
2063	2069	2081	2083	2087	2089	2099	2111	2113	2129
2131	2137	2141	2143	2153	2161	2179	2203	2207	2213
2221	2237	2239	2243	2251	2267	2269	2273	2281	2287
2293	2297	2309	2311	2333	2339	2341	2347	2351	2357
2371	2377	2381	2383	2389	2393	2399	2411	2417	2423
2437	2441	2447	2459	2467	2473	2477	2503	2521	2531
2539	2543	2549	2551	2557	2579	2591	2593	2609	2617
2621	2633	2647	2657	2659	2663	2671	2677	2683	2687
2689	2693	2699	2707	2711	2713	2719	2729	2731	2741
2749	2753	2767	2777	2789	2791	2797	2801	2803	2819
2833	2837	2843	2851	2857	2861	2879	2887	2897	2903
2909	2917	2927	2939	2953	2957	2963	2969	2971	2999
3001	3011	3019	3023	3037	3041	3049	3061	3067	3079
3083	3089	3109	3119	3121	3137	3163	3167	3169	3181
3187	3191	3203	3209	3217	3221	3229	3251	3253	3257
3259	3271	3299	3301	3307	3313	3319	3323	3329	3331
3343	3347	3359	3361	3371	3373	3389	3391	3407	3413
3433	3449	3457	3461	3463	3467	3469	3491	3499	3511
3517	3527	3529	3533	3539	3541	3547	3557	3559	3571
3581	3583	3593	3607	3613	3617	3623	3631	3637	3643
3659	3671	3673	3677	3691	3697	3701	3709	3719	3727
3733	3739	3761	3767	3769	3779	3793	3797	3803	3821
3823	3833	3847	3851	3853	3863	3877	3881	3889	3907
3911	3917	3919	3923	3929	3931	3943	3947	3967	3989
4001	4003	4007	4013	4019	4021	4027	4049	4051	4057
4073	4079	4091	4093	4099	4111	4127	4129	4133	4139
4153	4157	4159	4177	4201	4211	4217	4219	4229	4231
4241	4243	4253	4259	4261	4271	4273	4283	4289	4297
4327	4337	4339	4349	4357	4363	4373	4391	4397	4409
4421	4423	4441	4447	4451	4457	4463	4481	4483	4493
4507	4513	4517	4519	4523	4547	4549	4561	4567	4583
4591	4597	4603	4621	4637	4639	4643	4649	4651	4657
4663	4673	4679	4691	4703	4721	4723	4729	4733	4751
4759	4783	4787	4789	4793	4799	4801	4813	4817	4831
4861	4871	4877	4889	4903	4909	4919	4931	4933	4937
4943	4951	4957	4967	4969	4973	4987	4993	4999	5003
5009	5011	5021	5023	5039	5051	5059	5077	5081	5087
5099	5101	5107	5113	5119	5147	5153	5167	5171	5179

5189	5197	5209	5227	5231	5233	5237	5261	5273	5279
5281	5297	5303	5309	5323	5333	5347	5351	5381	5387
5393	5399	5407	5413	5417	5419	5431	5437	5441	5443
5449	5471	5477	5479	5483	5501	5503	5507	5519	5521
5527	5531	5557	5563	5569	5573	5581	5591	5623	5639
5641	5647	5651	5653	5657	5659	5669	5683	5689	5693
5701	5711	5717	5737	5741	5743	5749	5779	5783	5791
5801	5807	5813	5821	5827	5839	5843	5849	5851	5857
5861	5867	5869	5879	5881	5897	5903	5923	5927	5939
5953	5981	5987	6007	6011	6029	6037	6043	6047	6053
6067	6073	6079	6089	6091	6101	6113	6121	6131	6133
6143	6151	6163	6173	6197	6199	6203	6211	6217	6221
6229	6247	6257	6263	6269	6271	6277	6287	6299	6301
6311	6317	6323	6329	6337	6343	6353	6359	6361	6367
6373	6379	6389	6397	6421	6427	6449	6451	6469	6473
6481	6491	6521	6529	6547	6551	6553	6563	6569	6571
6577	6581	6599	6607	6619	6637	6653	6659	6661	6673
6679	6689	6691	6701	6703	6709	6719	6733	6737	6761
6763	6779	6781	6791	6793	6803	6823	6827	6829	6833
6841	6857	6863	6869	6871	6883	6899	6907	6911	6917
6947	6949	6959	6961	6967	6971	6977	6983	6991	6997
7001	7013	7019	7027	7039	7043	7057	7069	7079	7103
7109	7121	7127	7129	7151	7159	7177	7187	7193	7207
7211	7213	7219	7229	7237	7243	7247	7253	7283	7297
7307	7309	7321	7331	7333	7349	7351	7369	7393	7411
7417	7433	7451	7457	7459	7477	7481	7487	7489	7499
7507	7517	7523	7529	7537	7541	7547	7549	7559	7561
7573	7577	7583	7589	7591	7603	7607	7621	7639	7643
7649	7669	7673	7681	7687	7691	7699	7703	7717	7723
7727	7741	7753	7757	7759	7789	7793	7817	7823	7829
7841	7853	7867	7873	7877	7879	7883	7901	7907	7919

Acknowledgements