Jiang Function IsThe Greatest Prime Discovery That Was Ever Made (From Hardy-Littlewood(1923) To 2016 All Prime Papers Are Wrong)

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Abstract: The Hardy-Littlewood prime k-tuples conjecture[18,29,34] and Erdos-Turan conjecture(every set of integers of positive upper density contains arbitrarily long arithmetic progressions)[14,15,16,17,20,35] are wrong. Using the circle method and the sieve method one do not prove simplest twin prime conjecture(there exist infinitely many pairs of twin primes) and the simplest Goldbach conjecture (every even number N>4 is the sum of of two primes).

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The Hardy-Littlewood prime k-tuples conjecture[18,29,34] and Erdos-Turan conjecture(every set of integers of positive upper density contains arbitrarily long arithmetic progressions)[14,15,16,17,20,35] are wrong. Using the circle method and the sieve method one do not prove simplest twin prime conjecture(there exist infinitely many pairs of twin primes) and the simplest Goldbach conjecture (every even number N>4 is the sum of of two primes). Therefore from Hardy-Littlewood(1923) to 2014 all prime papers are wrong[12-50] .They do not prove any prime problems. they do not understand arithmetic progressions. The correct arithmetic progressions is Example 8[6,p68-74].Institute for Advanced study(Math) has long been recognized as the leading international center of research in pure mathematics. Ann.of Math. published many wrong prime papers, for example:Green-Tao[20,41],Goldston-Pintz-Yildirim[38],Wiles-Taylor[48,49],

Zhang[28] and other. Their papers are related to the Hardy-Littlewood wrong prime k-tuples conjecture[18,29,34,50].Therefore their papers are wrong.All Riemann hypothesis is wrong[51].All zeros of all zeta functions are wrong. But Ann.of Math(institute for advanced study) reject Jiang papers. Editors of Ann.of Math do not understand the prime theory and want to publish wrong prime papers.

Twin primes theorem[6,p341] .

$$P_2 = P_1 + 2$$

We have Jiang function to see example 1

$$J_2(\omega) = \prod_P (P-2) \neq 0$$

We prove that there exist infinitely many primes P_1 such that $P_1 + 2$ is prime. Therefore we prove twin primes theorem.

We have

$$\pi_2(N,2) = \left|\{P_1 \le N : P_1 + 2 = prime\}\right| \sim 2 \prod_{3\le P}\left(1 - \frac{1}{(P-1)^2}\right)\frac{N}{\log^2 N}.$$

Goldbach theorem[6,p341]

$$N = P_1 + P_2$$

We have Jiang function to see example 2

$$J_2(\omega) = \prod_{3\le P}(P-2)\prod_{P|N}\frac{P-1}{P-2} \neq 0$$

We prove that every even number $N \ge 6$ is the sum of two primes.Therefore we prove Goldbach theorem.

We have

$$\pi_2(N,2)=\left|\{P_1\le N: N-P=prime\}\right|\sim 2\prod_{3\le P}\left(1-\frac{1}{(P-1)^2}\right)\prod_{P|N}\frac{P-1}{P-2}\frac{N}{\log^2 N}$$

Using above method we prove about 2000 prime theorems[32].This paper is only correct prime theory, other prime theories are wrong, because they do not prove the simplest twin primes theorem and the simplest Goldbach theorem.

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Prime distribution is regularity $J_{n+1}(\omega)$ rather than probability 1/log N to see formula(8)

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Jiang's function $J_{n+1}(\omega)$ in prime distribution

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Abstract: We define that prime equations

$$f_1(P_1,\cdots,P_n),\cdots,f_k(P_1,\cdots P_n) \qquad (5)$$

are polynomials (with integer coefficients) irreducible over integers, where $P_1,\cdots,P_n$ are all the prime. If Jiang's function $J_{n+1}(\omega)=0$ then (5)has finite prime solutions. If $J_{n+1}(\omega)\ne 0$ then there are infinitely many primes $P_1,\cdots,P_n$ such that $f_1,\cdots f_k$ are primes. We obtain a unite prime formula in prime distribution

$$\pi_{k+1}(N,n+1)=\left|\{P_1,\cdots,P_n\le N: f_1,\cdots,f_k \text{ are } k \text{ primes}\}\right|$$

$$=\prod_{i=1}^{k}(\deg f_i)^{-1}\times\frac{J_{n+1}(\omega)\omega^k}{(n!)^k\phi^{k+n}(\omega)}\frac{N^n}{\log^{k+n}N}(1+o(1)). \qquad (8)$$

Jiang's function is accurate sieve function. Using Jiang's function we prove about 600 prime theorems [6]. Jiang's function provides proofs of the prime theorems which are simple enough to understand and accurate enough to be useful.

It will be another million years, at least, before we understand the primes.
Paul Erdos

Mathematicians have tried in vain to discover some order in the sequence of prime numbers but we have every reason to believe that there are some mysteries which the human mind will never penetrate.
Leonhard Euler

Suppose that Euler totient function

$$\phi(\omega)=\prod_{2\le P}(P-1)=\infty \quad \text{as} \quad \omega\to\infty, \qquad (1)$$

where $\omega=\prod_{2\le P}P$ is called primorial.

Suppose that $(\omega,h_i)=1$, where $i=1,\cdots,\phi(\omega)$. We have prime equations

$$P_1 = \omega n + 1, \cdots, P_{\phi(\omega)} = \omega n + h_{\phi(\omega)} \qquad (2)$$

where $n = 0,1,2,\cdots$.

(2) is called infinitely many prime equations (IMPE). Every equation has infinitely many prime solutions. We have

$$\pi_{h_i} = \sum_{\substack{P_i \le N \\ P_i \equiv h_i \pmod{\omega}}} 1 = \frac{\pi(N)}{\phi(\omega)}(1+o(1)). \qquad (3)$$

where π_{h_i} denotes the number of primes $P_i \le N$ in $P_i = \omega n + h_i$ $n = 0,1,2,\cdots$, $\pi(N)$ the number of primes less than or equal to N.

We replace sets of prime numbers by IMPE. (2) is the fundamental tool for proving the prime theorems in prime distribution.

Let $\omega = 30$ and $\phi(30) = 8$. From (2) we have eight prime equations

$$P_1 = 30n+1,\ P_2 = 30n+7,\ P_3 = 30n+11,\ P_4 = 30n+13,\ P_5 = 30n+17,$$
$$P_6 = 30n+19,\ P_7 = 30n+23,\ P_8 = 30n+29,\ n = 0,1,2,\cdots \qquad (4)$$

Every equation has infinitely many prime solutions.

THEOREM. We define that prime equations

$$f_1(P_1,\cdots,P_n),\cdots,f_k(P_1,\cdots,P_n) \qquad (5)$$

are polynomials (with integer coefficients) irreducible over integers, where $P_1,\cdots,P_n$ are primes. If Jiang's function $J_{n+1}(\omega) = 0$ then (5) has finite prime solutions. If $J_{n+1}(\omega) \ne 0$ then there exist infinitely many primes $P_1,\cdots,P_n$ such that each f_k is a prime.

PROOF. Firstly, we have Jiang's function [1-11]

$$J_{n+1}(\omega) = \prod_{3 \le P}[(P-1)^n - \chi(P)], \qquad (6)$$

where $\chi(P)$ is called sieve constant and denotes the number of solutions for the following special congruence

$$\prod_{i=1}^{k} f_i(q_1,\cdots,q_n) \equiv 0 \pmod{P}, \qquad (7)$$

where $q_1 = 1,\cdots,P-1,\cdots,q_n = 1,\cdots,P-1$.

$J_{n+1}(\omega)$ denotes the number of sets of $P_1,\cdots,P_n$ prime equations such that $f_1(P_1,\cdots,P_n),\cdots,f_k(P_1,\cdots,P_n)$ are prime equations. If $J_{n+1}(\omega) = 0$ then (5) has finite prime solutions. If $J_{n+1}(\omega) \ne 0$ using $\chi(P)$ we sift out from (2) prime equations which can not be represented $P_1,\cdots,P_n$, then residual prime equations of (2) are $P_1,\cdots,P_n$ prime equations such that $f_1(P_1,\cdots,P_n),\cdots,$ $f_k(P_1,\cdots,P_n)$ are prime equations. Therefore we prove that there exist infinitely many primes $P_1,\cdots,P_n$ such that $f_1(P_1,\cdots,P_n),\cdots,$ $f_k(P_1,\cdots,P_n)$ are primes.

Secondly, we have the best asymptotic formula [2,3,4,6]

$$\pi_{k+1}(N,n+1) = \left|\{P_1,\cdots,P_n \le N : f_1,\cdots,f_k \text{ are } k \text{ primes}\}\right|$$
$$= \prod_{i=1}^{k} (\deg f_i)^{-1} \times \frac{J_{n+1}(\omega)\omega^k}{(n!)^k \phi^{k+n}(\omega)} \frac{N^n}{\log^{k+n} N}(1+o(1)). \qquad (8)$$

(8) is called a unite prime formula in prime distribution. Let $n=1, k=0$, $J_2(\omega)=\phi(\omega)$. From (8) we have prime number theorem

$$\pi_1(N,2)=\left|\{P_1\le N: P_1 \text{ is prime}\}\right|=\frac{N}{\log N}(1+o(1)). \quad (9)$$

Number theorists believe that there are infinitely many twin primes, but they do not have rigorous proof of this old conjecture by any method. All the prime theorems are conjectures except the prime number theorem, because they do not prove that prime equations have infinitely many prime solutions. We prove the following conjectures by this theorem.

Example 1. Twin primes $P, P+2$ (300BC)**.**

From (6) and (7) we have Jiang's function

$$J_2(\omega)=\prod_{3\le P}(P-2)\neq 0. \quad (10)$$

Since $J_2(\omega)\neq 0$ in (2) exist infinitely many P prime equations such that $P+2$ is a prime equation. Therefore we prove that there are infinitely many primes P such that $P+2$ is a prime.

Let $\omega=30$ and $J_2(30)=3$. From (4) we have three P prime equations

$$P_3=30n+11, \quad P_5=30n+17, \quad P_8=30n+29.$$

From (8) we have the best asymptotic formula

$$\pi_2(N,2)=\left|\{P\le N: P+2 \text{ prime}\}\right|=\frac{J_2(\omega)\omega}{\phi^2(\omega)}\frac{N}{\log^2 N}(1+o(1))$$

$$=2\prod_{3\le P}\left(1-\frac{1}{(P-1)^2}\right)\frac{N}{\log^2 N}(1+o(1)). \quad (11)$$

In 1996 we proved twin primes conjecture [1]

Remark. $J_2(\omega)$ denotes the number of P prime equations, $\frac{\omega}{\phi^2(\omega)}\frac{N}{\log^2 N}(1+o(1))$ the number of solutions of primes for every P prime equation.

Example 2. Even Goldbach's conjecture $N=P_1+P_2$**.** Every even number $N\ge 6$ is the sum of two primes**.**

From (6) and (7) we have Jiang's function

$$J_2(\omega)=\prod_{3\le P}(P-2)\prod_{P|N}\frac{P-1}{P-2}\neq 0. \quad (12)$$

Since $J_2(\omega)\neq 0$ as $N\to\infty$ in (2) exist infinitely many P_1 prime equations such that $N-P_1$ is a prime equation. Therefore we prove that every even number $N\ge 6$ is the sum of two primes.

From (8) we have the best asymptotic formula

$$\pi_2(N,2)=\left|\{P_1\le N, N-P_1 \text{ prime}\}\right|=\frac{J_2(\omega)\omega}{\phi^2(\omega)}\frac{N}{\log^2 N}(1+o(1)).$$

$$=2\prod_{3\le P}\left(1-\frac{1}{(P-1)^2}\right)\prod_{P|N}\frac{P-1}{P-2}\frac{N}{\log^2 N}(1+o(1)). \quad (13)$$

In 1996 we proved even Goldbach's conjecture [1]

Example 3. Prime equations $P, P+2, P+6$**.**

From (6) and (7) we have Jiang's function

$$J_2(\omega)=\prod_{5\le P}(P-3)\neq 0,$$

$J_2(\omega)$ is denotes the number of P prime equations such that $P+2$ and $P+6$ are prime equations. Since $J_2(\omega)\neq 0$ in (2) exist infinitely many P prime equations such that $P+2$ and $P+6$ are prime equations. Therefore we prove that there are infinitely many primes P such that $P+2$ and $P+6$ are primes.

Let $\omega=30,\ J_2(30)=2$. From (4) we have two P prime equations

$$P_3=30n+11,\quad P_5=30n+17.$$

From (8) we have the best asymptotic formula

$$\pi_3(N,2)=\left|\{P\le N: P+2, P+6 \text{are primes}\}\right|=\frac{J_2(\omega)\omega^2}{\phi^3(\omega)}\frac{N}{\log^3 N}(1+o(1)). \quad (14)$$

Example 4. Odd Goldbach's conjecture $N=P_1+P_2+P_3$. Every odd number $N\ge 9$ is the sum of three primes.

From (6) and (7) we have Jiang's function

$$J_3(\omega)=\prod_{3\le P}\left(P^2-3P+3)\right)\prod_{P|N}\left(1-\frac{1}{P^2-3P+3}\right)\neq 0. \quad (15)$$

Since $J_3(\omega)\neq 0$ as $N\to\infty$ in (2) exist infinitely many pairs of P_1 and P_2 prime equations such that $N-P_1-P_2$ is a prime equation. Therefore we prove that every odd number $N\ge 9$ is the sum of three primes.

From (8) we have the best asymptotic formula

$$\pi_2(N,3)=\left|\{P_1,P_2\le N: N-P_1-P_2 \text{ prime}\}\right|=\frac{J_3(\omega)\omega}{2\phi^3(\omega)}\frac{N^2}{\log^3 N}(1+o(1)).$$

$$=\prod_{3\le P}\left(1+\frac{1}{(P-1)^3}\right)\prod_{P|N}\left(1-\frac{1}{P^3-3P+3}\right)\frac{N^2}{\log^3 N}(1+o(1)). \quad (16)$$

Using very complex circle method Helfgott deduces the Hardy-Littlewood formula of three prime problem[30,31],but Hardy-Littlewood-Vinogradov-Helfgott do not prove that every odd number N>7 is the sum of three prime numbers.Therefore their proofs are wrong.

Example 5. Prime equation $P_3=P_1P_2+2$.

From (6) and (7) we have Jiang's function

$$J_3(\omega)=\prod_{3\le P}\left(P^2-3P+2\right)\neq 0 \quad (17)$$

$J_3(\omega)$ denotes the number of pairs of P_1 and P_2 prime equations such that P_3 is a prime equation. Since $J_3(\omega)\neq 0$ in (2) exist infinitely many pairs of P_1 and P_2 prime equations such that P_3 is a prime equation. Therefore we prove that there are infinitely many pairs of primes P_1 and P_2 such that P_3 is a prime.

From (8) we have the best asymptotic formula

$$\pi_2(N,3)=\left|\{P_1,P_2\le N: P_1P_2+2 \text{ prime}\}\right|=\frac{J_3(\omega)\omega}{4\phi^3(\omega)}\frac{N^2}{\log^3 N}(1+o(1)). \quad (18)$$

Note. deg $(P_1P_2)=2$.

Example 6 [12]. Prime equation $P_3=P_1^3+2P_2^3$.

From (6) and (7) we have Jiang's function

$$J_3(\omega)=\prod_{3\le P}\left[(P-1)^2-\chi(P)\right]\neq 0, \quad (19)$$

where $\chi(P)=3(P-1)$ if $2^{\frac{P-1}{3}}\equiv 1(\bmod P)$; $\chi(P)=0$ if $2^{\frac{P-1}{3}}\not\equiv 1(\bmod P)$; $\chi(P)=P-1$ otherwise.

Since $J_3(\omega)\neq 0$ in (2) there are infinitely many pairs of P_1 and P_2 prime equations such that P_3 is a prime equation. Therefore we prove that there are infinitely many pairs of primes P_1 and P_2 such that P_3 is a prime.

From (8) we have the best asymptotic formula

$$\pi_2(N,3)=\left|\{P_1,P_2\le N: P_1^3+2P_2^3 \text{ prime}\}\right|=\frac{J_3(\omega)\omega}{6\phi^3(\omega)}\frac{N^2}{\log^3 N}(1+o(1)). \tag{20}$$

Example 7 [13]. Prime equation $P_3=P_1^4+(P_2+1)^2$.

From (6) and (7) we have Jiang's function

$$J_3(\omega)=\prod_{3\le P}\left[(P-1)^2-\chi(P)\right]\neq 0 \tag{21}$$

where $\chi(P)=2(P-1)$ if $P\equiv 1(\bmod 4)$; $\chi(P)=2(P-3)$ if $P\equiv 1(\bmod 8)$; $\chi(P)=0$ otherwise.

Since $J_3(\omega)\neq 0$ in (2) there are infinitely many pairs of P_1 and P_2 prime equations such that P_3 is a prime equation. Therefore we prove that there are infinitely many pairs of primes P_1 and P_2 such that P_3 is a prime.

From (8) we have the best asymptotic formula

$$\pi_2(N,3)=\left|\{P_1,P_2\le N: P_3 \text{ prime}\}\right|=\frac{J_3(\omega)\omega}{8\phi^3(\omega)}\frac{N^2}{\log^3 N}(1+o(1)). \tag{22}$$

Example 8 [14-20]. Arithmetic progressions consisting only of primes. We define the arithmetic progressions of length k.

$$P_1, P_2=P_1+d, P_3=P_1+2d,\cdots,P_k=P_1+(k-1)d,(P_1,d)=1. \tag{23}$$

From (8) we have the best asymptotic formula

$$\pi_2(N,2)=\left|\{P_1\le N: P_1,P_1+d,\cdots,P_1+(k-1)d \text{ are primes}\}\right|$$

$$=\frac{J_2(\omega)\omega^{k-1}}{\phi^k(\omega)}\frac{N}{\log^k N}(1+o(1)). \tag{24}$$

If $J_2(\omega)=0$ then (23) has finite prime solutions. If $J_2(\omega)\neq 0$ then there are infinitely many primes P_1 such that $P_2,\cdots,P_k$ are primes.

To eliminate d from (23) we have

$$P_3=2P_2-P_1,\quad P_j=(j-1)P_2-(j-2)P_1, 3\le j\le k. \tag{25}$$

From (6) and (7) we have Jiang's function

$$J_3(\omega)=\prod_{3\le P<k}(P-1)\prod_{k\le P}(P-1)(P-k+1)\neq 0 \tag{26}$$

Since $J_3(\omega)\neq 0$ there are infinitely many pairs of P_1 and P_2 prime equations such that $P_3,\cdots,P_k$ are prime equations. Therefore we prove that there are infinitely many pairs of primes P_1 and P_2 such that $P_3,\cdots,P_k$ are primes.

From (8) we have the best asymptotic formula

$$\pi_{k-1}(N,3) = \left|\left\{P_1, P_2 \le N : (j-1)P_2 - (j-2)P_1 \text{ prime}, 3 \le j \le k\right\}\right|$$

$$= \frac{J_3(\omega)\omega^{k-2}}{2^{k-2}\phi^k(\omega)} \frac{N^2}{\log^k N}(1+o(1)) \qquad = \frac{1}{2^{k-2}} \prod_{2 \le P < k} \frac{P^{k-2}}{(P-1)^{k-1}} \prod_{k \le P} \frac{P^{k-2}(P-k+1)}{(P-1)^{k-1}} \frac{N^2}{\log^k N}(1+o(1)).$$

(27)

Example 9. It is a well-known conjecture that one of $P, P+2, P+2^2$ is always divisible by 3. To generalize above to the $k-$ primes, we prove the following conjectures. Let n be a square-free even number.

1. $P, P+n, P+n^2$,

where $3 \mid (n+1)$.

From (6) and (7) we have $J_2(3)=0$, hence one of $P, P+n, P+n^2$ is always divisible by 3.

2. $P, P+n, P+n^2, \cdots, P+n^4$,

where $5 \mid (n+b), b = 2,3.$

From (6) and (7) we have $J_2(5)=0$, hence one of $P, P+n, P+n^2, \cdots, P+n^4$ is always divisible by 5.

3. $P, P+n, P+n^2, \cdots, P+n^6$,

where $7 \mid (n+b), b = 2,4.$

From (6) and (7) we have $J_2(7)=0$, hence one of $P, P+n, P+n^2, \cdots, P+n^6$ is always divisible by 7.

4. $P, P+n, P+n^2, \cdots, P+n^{10}$,

where $11 \mid (n+b), b = 3,4,5,9.$

From (6) and (7) we have $J_2(11)=0$, hence one of $P, P+n, P+n^2, \cdots, P+n^{10}$ is always divisible by 11.

5. $P, P+n, P+n^2, \cdots, P+n^{12}$,

where $13 \mid (n+b), b = 2,6,7,11.$

From (6) and (7) we have $J_2(13)=0$, hence one of $P, P+n, P+n^2, \cdots, P+n^{12}$ is always divisible by 13.

6. $P, P+n, P+n^2, \cdots, P+n^{16}$,

where $17 \mid (n+b), b = 3,5,6,7,10,11,12,14,15.$

From (6) and (7) we have $J_2(17)=0$, hence one of $P, P+n, P+n^2, \cdots, P+n^{16}$ is always divisible by 17.

7. $P, P+n, P+n^2, \cdots, P+n^{18}$,

where $19 \mid (n+b), b = 4,5,6,9,16.17.$

From (6) and (7) we have $J_2(19)=0$, hence one of $P, P+n, P+n^2, \cdots, P+n^{18}$ is always divisible by 19.

Example 10. Let n be an even number.

1. $P, P+n^i, i = 1,3,5,\cdots,2k+1$,

From (6) and (7) we have $J_2(\omega) \neq 0$. Therefore we prove that there exist infinitely many primes P such that $P, P+n^i$ are primes for any k.

2. $P, P+n^i, i=2,4,6,\cdots,2k$.

From (6) and (7) we have $J_2(\omega)\neq 0$. Therefore we prove that there exist infinitely many primes P such that $P, P+n^i$ are primes for any k.

Example 11. Prime equation $2P_2 = P_1 + P_3$

From (6) and (7) we have Jiang's function

$$J_3(\omega)=\prod_{3\le P}(P^2-3P+2)\neq 0. \quad (28)$$

Since $J_3(\omega)\neq 0$ in (2) there are infinitely many pairs of P_1 and P_2 prime equations such that P_3 is prime equations. Therefore we prove that there are infinitely many pairs of primes P_1 and P_2 such that P_3 is a prime.

From (8) we have the best asymptotic formula

$$\pi_2(N,3)=\left|\{P_1,P_2\le N: P_3 \text{ prime}\}\right|=\frac{J_3(\omega)\omega}{2\phi^3(\omega)}\frac{N^2}{\log^3 N}(1+o(1)). \quad (29)$$

In the same way we can prove $2P_2^2 = P_3 + P_1$ which has the same Jiang's function.

Jiang's function is accurate sieve function. Using it we can prove any irreducible prime equations in prime distribution. There are infinitely many twin primes but we do not have rigorous proof of this old conjecture by any method [22]. As strong as the numerical evidence may be, we still do not even know whether there are infinitely many pairs of twin primes [23]. All the prime theorems are conjectures except the prime number theorem, because they do not prove the simplest twin primes. They conjecture that the prime distribution is probability[12-28,33-35,38-47].

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On the singular series in the Jiang prime k-tuples theorem

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Abstract: Using Jiang function we prove Jiang prime k-tuples theorem.We find true singular series. Using the examples we prove the Hardy-Littlewood prime k-tuples conjecture with wrong singular series.. Jiang prime k-tuples theorem will replace the Hardy-Littlewood prime k-tuples conjecture.

(A) Jiang prime k-tuples theorem with true singular series[1, 2].

We define the prime k-tuples equation

$$p, p+n_i, \quad (1)$$

where $2|n_i, i=1,\cdots k-1$.

we have Jiang function [1, 2]

$$J_2(\omega)=\prod_P(P-1-\chi(P)), \quad (2)$$

where $\omega=\prod_P P$, $\chi(P)$ is the number of solutions of the following special congruence

$$\prod_{i=1}^{k-1}(q+n_i)\equiv 0 \pmod P, \quad q=1,\cdots,p-1. \quad (3)$$

which is true.

If $\chi(P)<P-1$ then $J_2(\omega)\neq 0$. There exist infinitely many primes P such that each of $P+n_i$ is prime. If $\chi(P)=P-1$ then $J_2(\omega)=0$. There exist finitely many primes P such that each of $P+n_i$ is prime. $J_2(\omega)$ is a subset of Euler function $\phi(\omega)$ [2].

If $J_2(\omega)\neq 0$, then we have the best asymptotic formula of the number of prime P [1, 2]

$$\pi_k(N,2)=\left|\{P\le N: P+n_i=prime\}\right|\sim\frac{J_2(\omega)\omega^{k-1}}{\phi^k(\omega)}\frac{N}{\log^k N}=C(k)\frac{N}{\log^k N} \quad (4)$$

$$\phi(\omega)=\prod_P(P-1)$$

$$C(k)=\prod_P\left(1-\frac{1+\chi(P)}{P}\right)\left(1-\frac{1}{P}\right)^{-k} \quad (5)$$

is Jiang true singular series.

It is the greatest prime discovery that was ever made.

Example 1. Let $k=2, P, P+2$, twin primes theorem.

From (3) we have

$\chi(2)=0, \quad \chi(P)=1$ if $P>2$, (6)

Substituting (6) into (2) we have

$$J_2(\omega)=\prod_{P\geq 3}(P-2)\neq 0 \qquad (7)$$

There exist infinitely many primes P such that $P+2$ is prime. Substituting (7) into (4) we have the best asymptotic formula

$$\pi_k(N,2)=\left|\{P\leq N: P+2=prime\}\right|\sim 2\prod_{P\geq 3}\left(1-\frac{1}{(P-1)^2}\right)\frac{N}{\log^2 N}. \qquad (8)$$

Example 2. Let $k=3, P, P+2, P+4$.

From (3) we have

$$\chi(2)=0, \quad \chi(3)=2 \qquad (9)$$

From (2) we have

$$J_2(\omega)=0. \qquad (10)$$

It has only a solution $P=3$, $P+2=5$, $P+4=7$. One of $P, P+2, P+4$ is always divisible by 3.

Example 3. Let $k=4, P, P+n$, where $n=2,6,8$.

From (3) we have

$\chi(2)=0, \chi(3)=1, \chi(P)=3$ if $P>3$. (11)

Substituting (11) into (2) we have

$$J_2(\omega)=\prod_{P\geq 5}(P-4)\neq 0, \qquad (12)$$

There exist infinitely many primes P such that each of $P+n$ is prime.

Substituting (12) into (4) we have the best asymptotic formula

$$\pi_4(N,2)=\left|\{P\leq N: P+n=prime\}\right|\sim\frac{27}{3}\prod_{P\geq 5}\frac{P^3(P-4)}{(P-1)^4}\frac{N}{\log^4 N} \qquad (13)$$

Example 4. Let $k=5$, P, $P+n$, where $n=2,6,8,12$.

From (3) we have

$\chi(2)=0, \chi(3)=1, \chi(5)=3, \chi(P)=4$ if $P>5$ (14)

Substituting (14) into (2) we have

$$J_2(\omega)=\prod_{P\geq 7}(P-5)\neq 0 \qquad (15)$$

There exist infinitely many primes P such that each of $P+n$ is prime. Substituting (15) into (4) we have the best asymptotic formula

$$\pi_5(N,2)=\left|\{P\leq N: P+n=prime\}\right|\sim\frac{15^4}{2^{11}}\prod_{P\geq 7}\frac{(P-5)P^4}{(P-1)^5}\frac{N}{\log^5 N} \qquad (16)$$

Example 5. Let $k=6$, P, $P+n$, where $n=2,6,8,12,14$.

From (3) and (2) we have

$$\chi(2)=0, \ \chi(3)=1, \ \chi(5)=4, \quad J_2(5)=0 \qquad (17)$$

It has only a solution $P=5$, $P+2=7$, $P+6=11$, $P+8=13$, $P+12=17$, $P+14=19$. One of $P+n$ is always divisible by 5.

(B) The Hardy-Littlewood prime k-tuples conjecture with wrong singular series[3-16].
This conjecture is generally believed to be true,
but has not been proved(Odlyzko et al.Jumping champion,experiment math,8(1999),107-118).

We define the prime k-tuples equation

$$P, P+n_i \qquad (18)$$

where $2|n_i, i=1,\cdots,k-1$.

In 1923 Hardy and Littlewood conjectured the asymptotic formula

$$\pi_k(N,2)=\left|\{P\le N: P+n_i=prime\}\right|\sim H(k)\frac{N}{\log^k N}, \qquad (19)$$

where

$$H(k)=\prod_P\left(1-\frac{\nu(P)}{P}\right)\left(1-\frac{1}{P}\right)^{-k} \qquad (20)$$

is Hardy-Littlewood wrong singular series,

It is the greatest prime mistake that was ever made

$\nu(P)$ is the number of solutions of congruence

$$\prod_{i=1}^{k-1}(q+n_i)\equiv 0 \pmod P, \quad q=1,\cdots,P. \qquad (21)$$

which is wrong.

From (21) we have $\nu(P)<P$ and $H(k)\ne 0$. For any prime k-tuples equation there exist infinitely many primes P such that each of $P+n_i$ is prime, which is false.

Conjecture 1. Let $k=2, P, P+2$, twin primes theorem

From (21) we have

$$\nu(P)=1 \qquad (22)$$

Substituting (22) into (20) we have

$$H(2)=\prod_P\frac{P}{P-1} \qquad (23)$$

Substituting (23) into (19) we have the asymptotic formula

$$\pi_2(N,2)=\left|\{P\le N: P+2=prime\}\right|\sim\prod_P\frac{P}{P-1}\frac{N}{\log^2 N} \qquad (24)$$

which is wrong see example 1.

Conjecture 2. Let $k=3, P, P+2, P+4$.

From (21) we have

$$\nu(2)=1,\ \nu(P)=2 \text{ if } P>2 \qquad (25)$$

Substituting (25) into (20) we have

$$H(3)=4\prod_{P\ge 3}\frac{P^2(P-2)}{(P-1)^3} \qquad (26)$$

Substituting (26) into (19) we have asymptotic formula

$$\pi_3(N,2)=\left|\{P\le N: P+2=prime, P+4=prim\}\right|\sim 4\prod_{P\ge 3}\frac{P^2(P-2)}{(P-1)^3}\frac{N}{\log^3 N} \qquad (27)$$

which is wrong see example 2.

Conjecture 3. Let $k=4$, $P, P+n$, where $n=2,6,8$.

From (21) we have

$$\nu(2)=1,\ \nu(3)=2,\ \nu(P)=3 \text{ if } P>3 \qquad (28)$$

Substituting (28) into (20) we have

$$H(4)=\frac{27}{2}\prod_{P>3}\frac{P^3(P-3)}{(P-1)^4} \quad (29)$$

Substituting (29) into (19) we have asymptotic formula

$$\pi_4(N,2)=\left|\{P\le N: P+n=prime\}\right|\sim\frac{27}{2}\prod_{P>3}\frac{P^3(P-3)}{(P-1)^4}\frac{N}{\log^4 N} \quad (30)$$

Which is wrong see example 3.

Conjecture 4. Let $k=5,\ P, P+n$, where $n=2,6,8,12$

From (21) we have

$$\nu(2)=1,\ \nu(3)=2,\ \nu(5)=3,\ \nu(P)=4 \text{ if } P>5 \quad (31)$$

Substituting (31) into (20) we have

$$H(5)=\frac{15^4}{4^5}\prod_{P>5}\frac{P^4(P-4)}{(P-1)^5} \quad (32)$$

Substituting (32) into (19) we have asymptotic formula

$$\pi_5(N,2)=\left|\{P\le N: P+n=prime\}\right|\sim\frac{15^4}{4^5}\prod_{P>5}\frac{P^4(P-4)}{(P-1)^5}\frac{N}{\log^5 N} \quad (33)$$

Which is wrong see example 4.

Conjecture 5. Let $k=6$, P, $P+n$, where $n=2,6,8,12,14$.

From (21) we have

$$\nu(2)=1,\ \nu(3)=2,\ \nu(5)=4,\ \nu(P)=5 \text{ if } P>5 \quad (34)$$

Substituting (34) into (20) we have

$$H(6)=\frac{15^5}{2^{13}}\prod_{P>5}\frac{(P-5)P^5}{(P-1)^6} \quad (35)$$

Substituting (35) into (19) we have asymptotic formula

$$\pi_6(N,2)=\left|\{P\le N: P+n=prime\}\right|\sim\frac{15^5}{2^{13}}\prod_{P>5}\frac{(P-5)P^5}{(P-1)^6}\frac{N}{\log^6 N} \quad (36)$$

which is wrong see example 5.

Conclusion. From Hardy-Littlewood(1923) to 2014 all prime papers are wrong. The Jiang prime k-tuples theorem has true singular series. The Hardy-Littlewood prime k-tuples conjecture has wrong singular series. The tool of additive prime number theory is basically the Hardy-Littlewood wrong prime k-tuples conjecture [3-15]. Using Jiang true singular series we prove almost all prime theorems. Jiang prime k-tuples theorem will replace Hardy-Littlewood prime k-tuples conjecture. There cannot be really modern prime theory without Jiang function.

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The New Prime theorem（5）

$$P, jP+k-j (j=1,\cdots,k-1)$$

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Abstract

Using Jiang function we prove that there exist infinitely many primes P such that each $jP+k-j$ is a prime.

Theorem. Let k be a given prime.

$$P, jP+k-j (j=1,\cdots,k-1) \quad (1)$$

There exist infinitely many primes P such that each of $jP+k-j$ is a prime.

Proof. We have Jiang function[1]

$$J_2(\omega)=\prod_P [P-1-\chi(P)], \quad (2)$$

where

$$\omega=\prod_P P,$$

$\chi(P)$ is the number of solutions of congruence

$$\prod_{j=1}^{k-1}(jq+k-j)\equiv 0 \pmod P, \quad (3)$$

$$q=1,\cdots,P-1.$$

From (3) we have $\chi(2)=0$, if $P<k$ then $\chi(P)=P-2$, $\chi(k)=1$, if $k<P$ then $\chi(P)=k-1$.
From (3) and (2) we have

$$J_2(\omega)=(k-2)\prod_{k<P}(P-k)\neq 0. \quad (4)$$

We prove that there exist infinitely many primes P such that each of $jP+k-j$ is a prime
We have the asymptotic formula [1]

$$\pi_k(N,2)=\left|\{P\le N: jP+k-j=prime\}\right|\sim\frac{J_2(\omega)\omega^{k-1}}{\phi^k(\omega)}\frac{N}{\log^k N}, \quad (5)$$

where $\phi(\omega)=\prod_P(P-1)$.

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The Complex Hyperbolic Functions Are The Greatest Mathematical Discovery That Was Ever Made

Fermat Last Theorem was Proved in 1991

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We found out a new method for proving Fermat last theorem (FLT) on the afternoon of October 25, 1991. We proved FLT at one stroke for all prime exponents $p>3$, It led to the discovery to calculate $n=15,21,35,105,\cdots\cdots$. To this date, no one disprove this proof. Anyone can not deny it, because it is a simple and marvelous proof. It can fit in the margin of Fermat book.

In 1974 we found out Euler formula of the cyclotomic real numbers in the cyclotomic fields [1].

$$\exp\left(\sum_{i=1}^{n-1} t_i J^i\right)=\sum_{i=1}^{n} S_i J^{i-1}, \quad (1)$$

where J denotes a n- th root of unity, $J^n=1$, n is an odd number, t_i are the real numbers. S_i is called the complex hyperbolic functions of order n with $n-1$ variables,

$$S_i=\frac{1}{n}[e^A+2\sum_{i=1}^{\frac{n-1}{2}}(-1)^{(i-1)j}e^{B_j}\cos(\theta_j+(-1)^j\frac{(i-1)j\pi}{n})], \quad (2)$$

where

$$A=\sum_{\alpha=1}^{n-1}t_\alpha,\ B_j=\sum_{\alpha=1}^{n-1}t_\alpha\ (-1)^{\alpha j}\cos\frac{\alpha j\pi}{n},\theta_j=(-1)^{j+1}\sum_{\alpha=1}^{n-1}t_\alpha\ (-1)^{\alpha j}\sin\frac{\alpha j\pi}{n},$$

$$A+2\sum_{i=1}^{\frac{n-1}{2}}B_i=0. \quad (3)$$

Using (1) the cyclostomes theory may extend to totally real number fields. It is called the hypercomplex variable theory [1]. (2) may be written in the matrix form

$$\begin{bmatrix} S_1 \\ S_2 \\ S_3 \\ \cdots \\ S_n \end{bmatrix} = \frac{1}{n} \begin{bmatrix} 1 & 1 & 0 & \cdots & 0 \\ 1 & -\cos\frac{\pi}{n} & -\sin\frac{\pi}{n} & \cdots & -\sin\frac{(n-1)\pi}{2n} \\ 1 & \cos\frac{2\pi}{n} & \sin\frac{2\pi}{n} & \cdots & -\sin\frac{(n-1)\pi}{n} \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ 1 & \cos\frac{(n-1)\pi}{n} & \sin\frac{(n-1)\pi}{n} & \cdots & -\sin\frac{(n-1)^2\pi}{2n} \end{bmatrix} \begin{bmatrix} e^A \\ 2e^{B_1}\cos\theta_1 \\ 2e^{B_1}\sin\theta_1 \\ \cdots \\ 2\exp(B_{\frac{n-1}{2}})\sin(\theta_{\frac{n-1}{2}}) \end{bmatrix},$$

(4)

where $(n-1)/2$ is an even number.

From (4) we may obtain its inverse transformation

$$\begin{bmatrix} e^A \\ e^{B_1}\cos\theta_1 \\ e^{B_1}\sin\theta_1 \\ \cdots \\ \exp(B_{\frac{n-1}{2}})\sin(\theta_{\frac{n-1}{2}}) \end{bmatrix} = \begin{bmatrix} 1 & 1 & 1 & \cdots & 1 \\ 1 & -\cos\frac{\pi}{n} & \cos\frac{2\pi}{n} & \cdots & \cos\frac{(n-1)\pi}{n} \\ 0 & -\sin\frac{\pi}{n} & \sin\frac{2\pi}{n} & \cdots & \sin\frac{(n-1)\pi}{n} \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ 0 & -\sin\frac{(n-1)\pi}{2n} & -\sin\frac{(n-1)\pi}{n} & \cdots & -\sin\frac{(n-1)^2\pi}{2n} \end{bmatrix} \begin{bmatrix} S_1 \\ S_2 \\ S_3 \\ \cdots \\ S_n \end{bmatrix}. \quad (5)$$

From (5) we have

$$e^A = \sum_{i=1}^{n} S_i, e^{B_j}\cos\theta_j = S_1 + \sum_{i=1}^{n-1} S_{1+i}(-1)^{ij}\cos\frac{ij\pi}{n},$$

$$e^{B_j}\sin\theta_j = (-1)^{j+1}\sum_{i=1}^{n-1} S_{1+i}(-1)^{ij}\sin\frac{ij\pi}{n}. \quad (6)$$

In (3) and (6) t_i and S_i have the same formulas such that every factor of n has a Fermat equation. Assume $S_1 \neq 0$, $S_2 \neq 0$, $S_i = 0$ where $i = 3,4,\cdots$, $n. S_i = 0$ are $n-2$ indeterminate equations with $n-1$ variables. From (6) we have

$$e^A = S_1 + S_2, \quad e^{2B_j} = S_1^2 + S_2^2 + 2S_1S_2(-1)^j\cos\frac{j\pi}{n}. \quad (7)$$

From (3) and (7) we may obtain the Fermat equation

$$\exp\left(A + 2\sum_{j=1}^{\frac{n-1}{2}} B_j\right) = (S_1 + S_2)\prod_{j=1}^{\frac{n-1}{2}} (S_1^2 + S_2^2 + 2S_1S_2(-1)^j\cos\frac{j\pi}{n}) = S_1^n + S_2^n = 1. \quad (8)$$

Theorem. Fermat last theorem has no rational solutions with $S_1S_2 \neq 0$ for all odd exponents.

Proof. The proof of FLT is difficult when n is an odd prime. We consider n is a composite number.

Let $n = \prod n_i$, where n_i ranges over all odd number. From (3) we have

$$\exp(A+2\sum_{j=1}^{\frac{f-1}{2}} B_{\frac{n}{f}j}) = [\exp(\sum_{\alpha=1}^{\frac{n}{f}-1} t_{f\alpha})]^f \tag{9}$$

From (7) we have

$$\exp(A+2\sum_{j=1}^{\frac{f-1}{2}} B_{\frac{n}{f}j}) = S_1^f + S_2^f \tag{10}$$

where f is a factor of n. From (9) and (10) we may obtain Fermat equation

$$\exp(A+2\sum_{j=1}^{\frac{f-1}{2}} B_{\frac{n}{f}j}) = S_1^f + S_2^f = [\exp(\sum_{\alpha=1}^{\frac{n}{f}-1} t_{f\alpha})]^f \tag{11}$$

Every factor of n has a Fermat equation. From (11) we have

$$f=1, B_n = B_0 = 0, \quad e^A = S_1 + S_2 = \exp(\sum_{\alpha=1}^{n-1} t_\alpha) \tag{12}$$

$$f=n, t_n = t_0 = 0, \quad \exp(A+2\sum_{i=1}^{\frac{n-1}{2}} B_j) = S_1^n + S_2^n = 1 \tag{13}$$

$$f=3, \exp(A+2B_{\frac{n}{3}}) = S_1^3 + S_2^3 = [\exp(\sum_{\alpha=1}^{\frac{n}{3}-1} t_{3\alpha})]^3 \tag{14}$$

If $S_1=1, S_2=0$ and $S_1=0, S_2=1$, then $A=B_j=0$. Euler proved (13), therefore (11) has no rational solutions with $S_1S_2 \neq 0$ (and so no integer solutions with $S_1S_2 \neq 0$) for all odd exponents f. (11) and (13) can fit in the margin of Fermat book.

Let $n=3p$ where p is an odd prime. From (3) and (7) we may derive Fermat equitations

$$\exp(A+2\sum_{i=1}^{\frac{3p-1}{2}} B_j) = S_1^{3p} + S_2^{3p} = (S_1^p)^3 + (S_2^p)^3 = 1 \tag{15}$$

$$\exp(A+2B_p) = S_1^3 + S_2^3 = [\exp\sum_{\alpha=1}^{p-1} t_{3\alpha})]^3 \tag{16}$$

$$\exp(A+2\sum_{i=1}^{\frac{p-1}{2}} B_{3j}) = S_1^p + S_2^p = [\exp(t_p + t_{2p})]^p \tag{17}$$

Euler proved (15) and (16), therefore (17) have no rational solutions with $S_1S_2 \neq 0$ (and so no integer solutions with $S_1S_2 \neq 0$) for any odd prime $p>3$. (15)-(17) can fit in the margin

Let $n=5p$ where p is an odd prime. From (3) and (7) we may derive Fermat eqations

$$\exp(A+2\sum_{j=1}^{\frac{5p-1}{2}} B_j) = S_1^{5p} + S_2^{5p} = 1 \tag{18}$$

$$\exp(A+2B_p+2B_{2p})=S_1^5+S_2^5=[\exp\sum_{\alpha=1}^{p-1}t_{5\alpha})]^5 \tag{19}$$

$$\exp(A+2\sum_{j=1}^{\frac{p-1}{2}}B_{5j})=S_1^p+S_2^p=[\exp(\sum_{\alpha=1}^{4}t_{p\alpha})]^p \tag{20}$$

(18)-(20) can fit in the margin.

Let $n=7p$ where p is an odd prime. From (3) and (7) we may derive Fermat equations

$$\exp(A+2\sum_{i=1}^{\frac{7p-1}{2}}B_j)=S_1^{7p}+S_2^{7p}=1 \tag{21}$$

$$\exp(A+2B_p+2B_{2p}+2B_{3p})=S_1^7+S_2^7=[\exp\sum_{\alpha=1}^{p-1}t_{7\alpha})]^7 \tag{22}$$

$$\exp(A+2\sum_{i=1}^{\frac{p-1}{2}}B_{7j})=S_1^p+S_2^p=[\exp\sum_{\alpha=1}^{6}t_{p\alpha})]^p \tag{23}$$

(21)-(23) can also fit in the margin.

Using this method we proved FLT in 1991 [2-5].

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Note. Let one knew the important results, we gave out about 600 preprints in 1991-1992. There were my preprints in Princeton, Harvard, Berkeley, MIT, Uchicago, Columbia, Maryland, Ohio, Wisconsin, Yale, ⋯ ⋯, England, Canada, Japan, Poland, Germany, France, Finland, ⋯ ⋯, Ann. Math., Mathematika, J. Number Theory, Glasgow Math. J., London Math. Soc., In. J. Math. Math. Sci., Acta Arith., Can. Math. Bull. (They refused the publications of my papers). Both papers were published in Chinese. FLT is as simple as Pythagorean theorem. This proof can fit in the margin of Fermat book. We think the game is up. We sent dept of math (Princeton University) a preprint on Jan. 15, 1992. Wiles claims the second proof of FLT in England (not in U. S. A.) after two years. We wish Wiles and his supporters disprove my proof, otherwise Wiles work is only the second and complex proof of FLT. We believe that the Princeton is the fairest University and history will pass the fairest judgment on proofs of FLT and other problems. We are waiting for word from the experts who are studying this paper.

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